Vol. XVI, No. 1 FEBRUARY, 1946

THE TOOL ENGINEER

OFFICIAL PUBLICATION OF THE ASTE AMERICAN SOCIETY OF TOOL ENGINEERS

Behind every product that is mass produced is the tool engineer

How To Buy
PRATT & WHITNEY MACHINES
from U. S. Government Surplus Stock

We are glad to offer our help and experience to prospective buyers of Pratt & Whitney machines that are offered for sale as surplus equipment. If you are interested in acquiring a government surplus Pratt & Whitney machine tool, go to the nearest P&W Branch Office and make your wants known. We will work with you and the RFC Office to find the machine that suits your requirements. We will give you the specifications and literature covering our *standard model* of that particular type.

To all prospective buyers of P&W machines we wish to offer a word of advice. Included in government surplus stock are many *special* P&W machines . . . standard models that have been either specially tooled, or adapted to a particular job, or modified for special purposes. Such machines are *not usable for general work* until they have been reconverted to standard.

We are anxious to see that every future owner of a Pratt & Whitney machine tool bought from government surplus is getting fully satisfactory results from his purchase. For complete details contact our nearest Branch Office as listed below and talk to our engineers.

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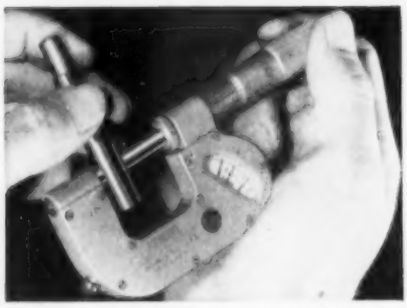
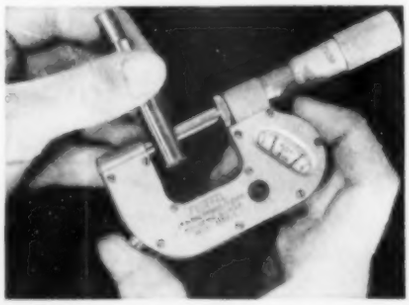
THE FEDERAL INDICATING MICROMETER



USED AS A MICROMETER — spindle is brought into contact until Indicator reads "O".



USED AS A GAGE — push button retracts anvil and dimension is checked on dial.

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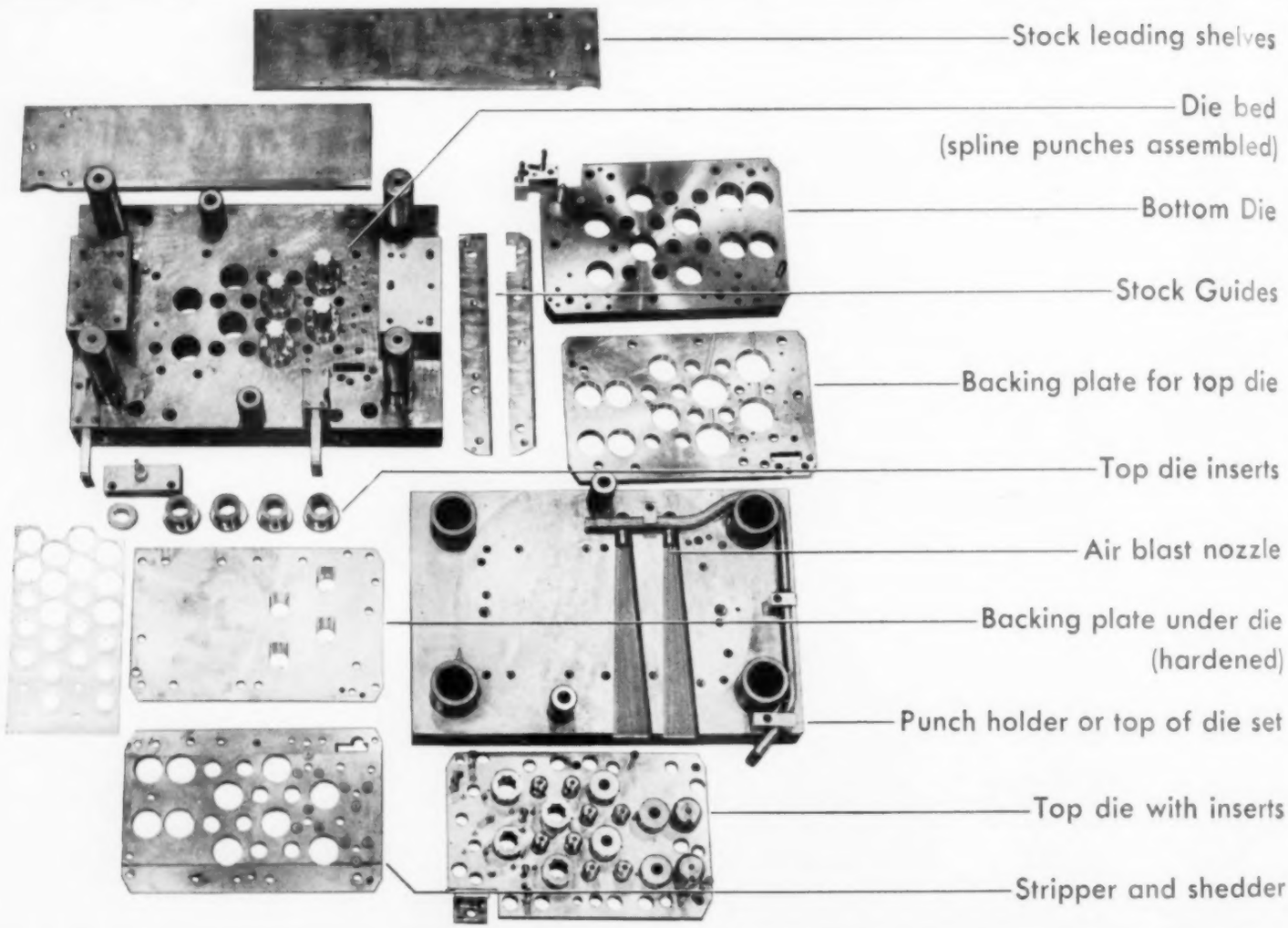
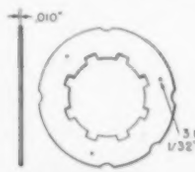
Decimatic is now available on STANDARD Dial Bore Gages and Dial Comparators.

STANDARD GAGE CO., Inc., Poughkeepsie, N.Y.

Could you produce 10 of these dies in 5 months by your present methods?



QUADRUPLE DIES PRODUCED INTERCHANGEABLY IN THE MOORE SPECIAL TOOL COMPANY'S TOOLROOM



TAKE A GOOD LOOK at this disassembled quadruple die. Combining compound and progressive features, it produced at every press stroke four fragile splined washers to close dimensions.

Now take another look. *Ten of these dies were made in five months.*

Impossible, you say? Yes, without advanced and accurate hole location methods. To start with, the piece parts would have to be stamped out in one-at-a-time dies instead of quadruple. And since the die parts could only be made progressively, a single die would be a one-man assignment. Add to this, transferring hardening distortion errors through the die into the other plates. At least a

year of uninterrupted production would be required to complete one die.

But this mass-die-production is a triumph of the principle of interchangeable parts-and-assembly applied to toolmaking...made possible by the Moore Jig Borer and the Moore Jig Grinder working as toolroom partners. Accurate hole locations could be attained with speed and ease *only* by jig-boring the holes, applying the Moore lead screw principle of coordinate hole location and, after hardening, finish-grinding them on the only machine of its kind—the Moore Jig Grinder.

The first die was produced in three months! All parts were made concurrently to pre-engineered dimensions right down to the dowel holes in the compound-station inserts. And even the detents in the final blanking punches were jig-ground; the detents in the blanking dies were inserted round pieces, set into jig-ground holes.

Complex dies produced and assembled like automobile parts! And you can do the same. *You, too, can work to figures instead of "to fit."* Start on it today by writing for complete literature on the Moore Jig Borer and Moore Jig Grinder.

MOORE SPECIAL TOOL COMPANY, INC.
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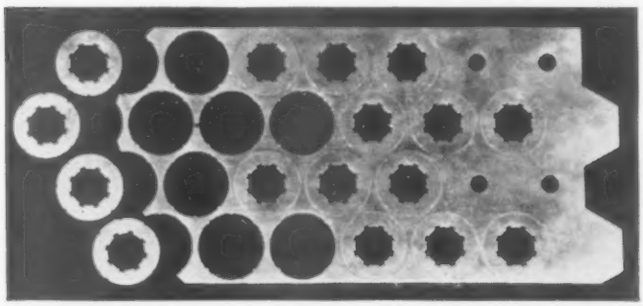
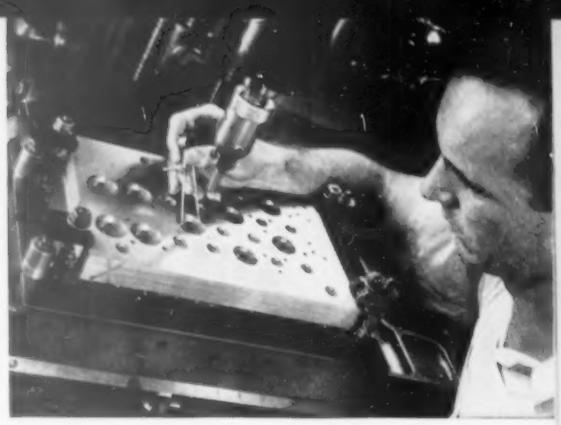
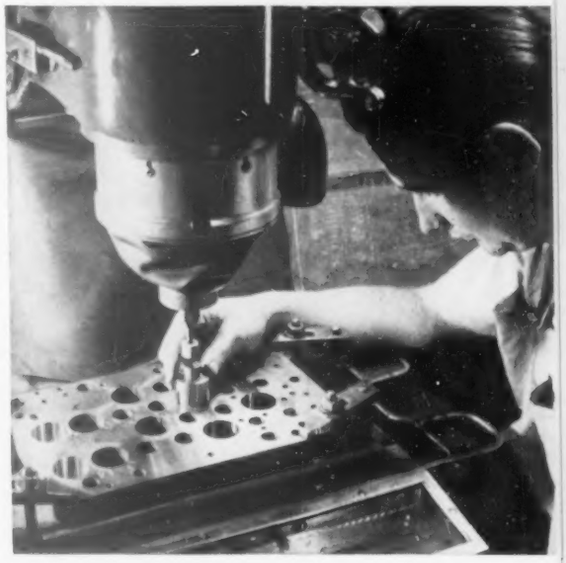


Scrap and four splined washers produced at every press stroke



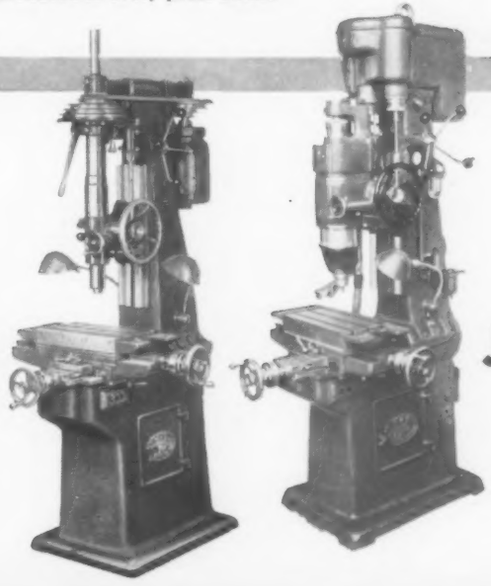
Here's Interchangeability in Toolmaking

How duplicate die blocks of 10 quadruple dies were p duced concurrently for interchangeable assembly. Holes die block are bored in Moore Jig Borer while equivale holes in a duplicate die block are ground, after hardeni in Moore Jig Grinder.



MOORE MAKES TOOLS

MOORE JIG BORER



MOORE JIG GRINDER

SPINDLE EXTENDED 42"...DIMENSIONS

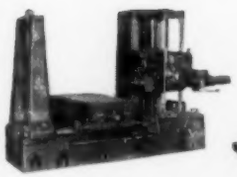
G.&L. Machine Permits Extending Spindle to Cutting Surfaces Performing Precision Boring, Milling, Grooving, Slotting and Facing Operations on Irregular Shaped and Unwieldy Work

Performing an intricate milling operation on a hoist component. Spindle and cutter are extended more than 30". Maximum continuous feed for the 350-T machine is 36".

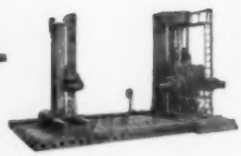
Unusual shaped machinery parts having projecting arms, flanges, flats or pads are handled with little trouble merely by extending the spindle on the G. & L. Horizontal Boring Machine to reach the surface to be machined. Here are two excellent examples of how such machining work is done in less time by traversing the spindle and cutter to the surface being machined. Although the cutting tool is 42" from the horizontal boring machine headstock, while facing the manifold flange, accuracy is maintained. Required dimensions are held within .001" on the alloy steel inlet valve manifold and .002" on the copper silicon sprocket housing. A high finish is produced on both parts.

Spindle Travel in 4 Directions Coupled With Open Construction Offers Wide Machining Range for Difficult Work

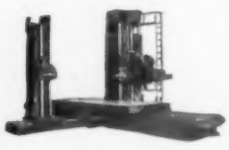
Regardless of the size and shape of weldments and castings, they are handled more easily and machined better on a G. & L. Horizontal Boring Machine. Mounting odd shaped work with extensions in any plane is unhampered by interfering machine columns, rails or other com-



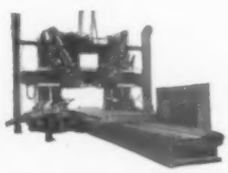
G. & L. Table Type Machine



G. & L. Floor Type Machine



G. & L. Planer Type Machine



G. & L. Multiple Head Type Machine

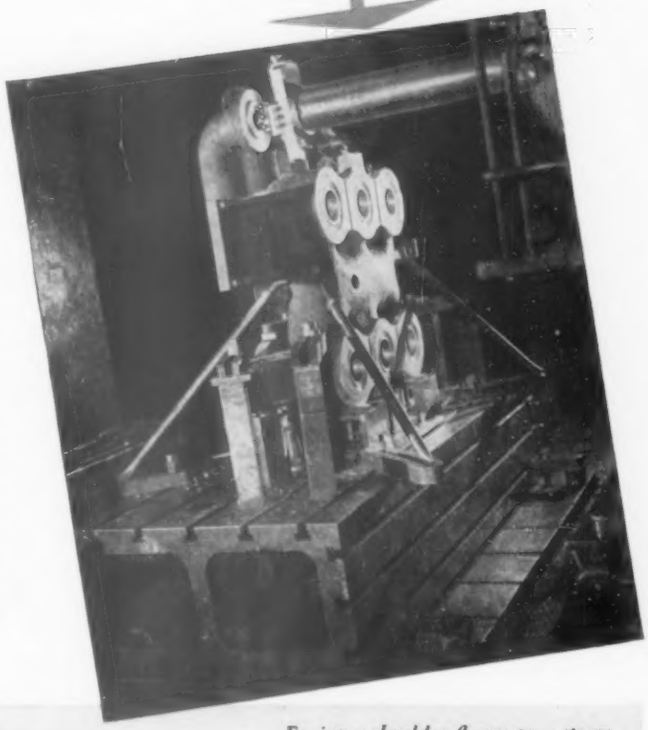
GIDDINGS & LEWIS MACHINE TOOL CO.

HELD TO .001"...HIGH FINISH PRODUCED

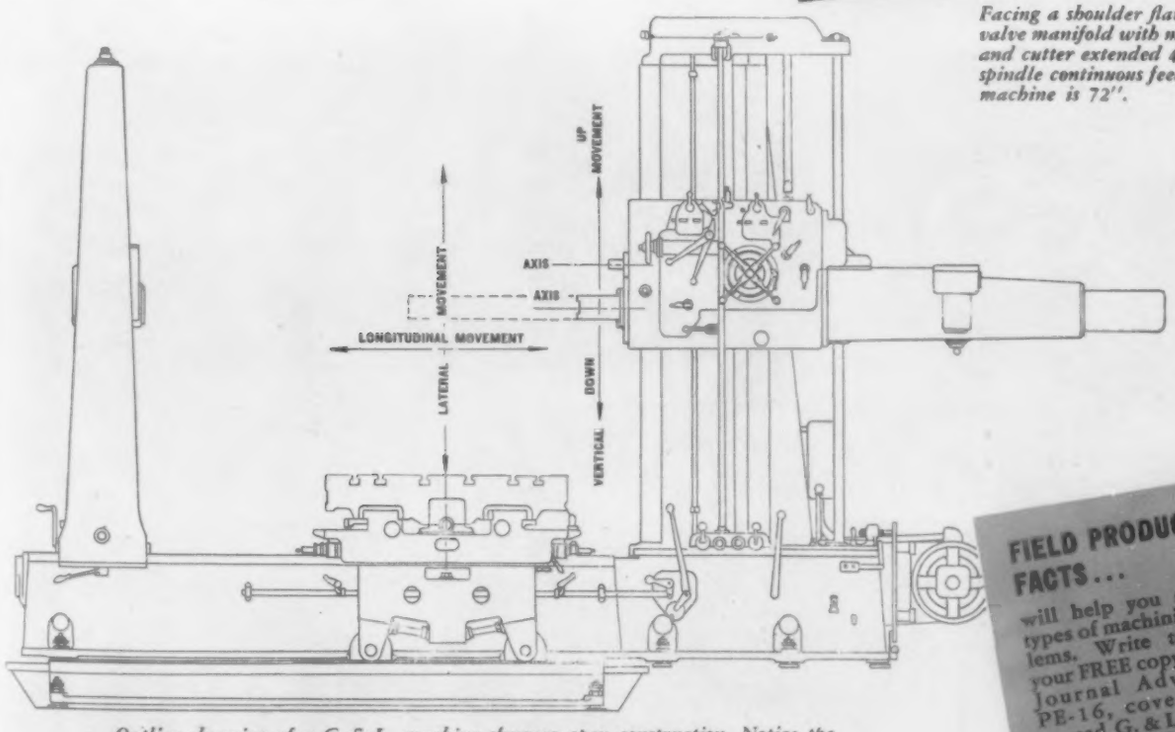
ponents. Once the work is positioned for machining, the spindle can be extended to reach surfaces for milling, facing, boring, drilling or other similar operations. As a result of combined machine and spindle feed movements, design engineers are able to produce parts that would be impractical to handle on any other type equipment.

IN *Your* PLANT...

When machining problems are difficult, a simple way to solve them is to call on experienced Giddings & Lewis engineers. Complete machining methods and tool requirements for improved production will be offered to you without obligation. Outline your problem now or send prints.



Facing a shoulder flange on a steam valve manifold with machine spindle and cutter extended 42". Maximum spindle continuous feed for this 780-F machine is 72".



Outline drawing of a G. & L. machine showing open construction. Notice the longitudinal, lateral and vertical movements possible, plus the way in which the spindle can be extended.

FIELD PRODUCTION FACTS...

will help you solve all types of machining problems. Write today for your FREE copy of Trade Journal Advertising PE-16, covering advanced G. & L. Horizontal Boring, Drilling and Milling Machine practices. Kindly indicate your business connection.

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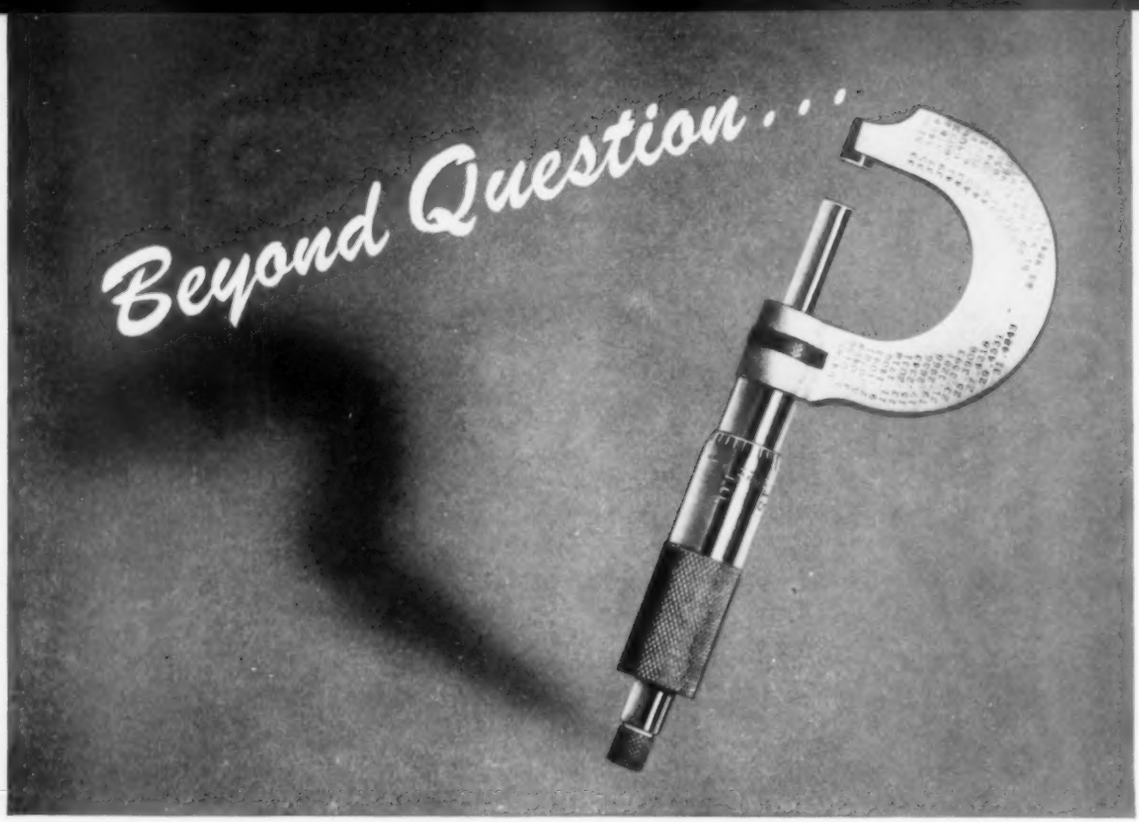
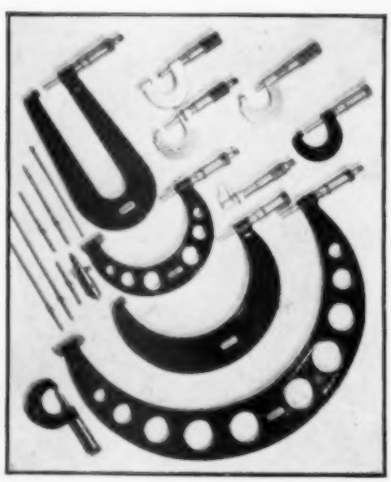


When it's a STARRETT "Mike"



Your machine workers and inspectors take the accuracy of a Starrett "Mike" for granted and what's more, they have no question of your knowledge of tools and your desire to provide them with the finest when you standardize on Starrett Micrometers in every tool crib.

Familiarity with and confidence in the precision tools you provide is an important factor in both the quality and quantity of precision work your shop turns out. That's why it pays to ask your supply house for STARRETT Micrometer Sets.

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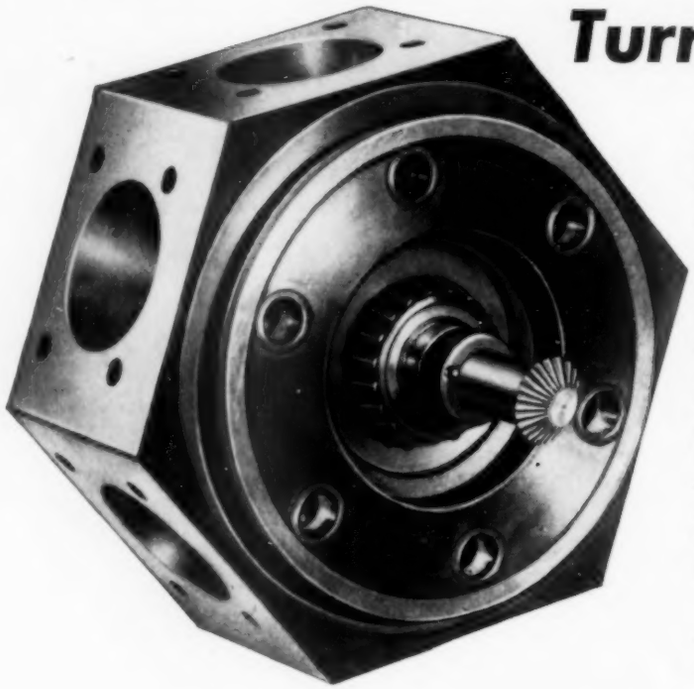

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It is but seldom that the man who invents also manufactures or prepares his brain child for manufacturing. Invariably, the problem of production goes to the skilled technician who, in modern parlance, we call the tool engineer. It is his knowledge and ingenuity which make it possible to lift a product from the designing and illustration board and to put it into the hands of industry or of the public.

Due to the requirements of his increasingly demanding profession, the tool engineer has, in recent years, become not only a "doer" but a "thinker-upper" or a "dreamer" as well. Usually, his study and analysis of a product, from the manufacturing side, leads to simpler and less costly manufacturing. His trained ability to translate all designs into the realm of the practical often results not only in improved appearance of the product, but in a functional improvement as well.

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The technical sessions, that each of our more than seventy-two A.S.T.E. Chapters hold once a month, represent a virtual post-graduate course in tool engineering. Authorities on tooling, gear cutting, lubrication and on the innumerable processes and methods involved in manufacturing, tool engineers are forever studying ways and means of improving processes and techniques for mass production. Never static, tool engineering is one of the livest of professions.

To management, especially, the tool engineer has become one of the most important cogs in industry. He is the "intermediate" of the change gears in the industrial machine, reconciling advancing wage scales and costs of production. He cuts costs for the employer and, at the same time, lightens the burden of the worker on the machine.

The success of the A.S.T.E., in the comparatively few years in which our Society has grown from a handful of members to over 18,000 in number, can be largely attributed to the fact that the Society comprises a group of men who have the desire to progress in their profession. In that, the Society has offered them tangible ways in which to make that advancement.

Various activities of the A.S.T.E., offer an interchange of ideas. The A.S.T.E., operates like a clearing house, only, unlike a banking institution, our kind of a "clearing house," clears ideas, methods and processes designed to make the tool engineer more useful to industry and to himself. Periodic contact with his fellow members constantly broadens his viewpoints, and also keeps him from being a mere unimaginative technician. It has made him both a dreamer and a doer.

You can be sure that many inventors, of the future, will come out of the tool engineering profession just as, in bygone years, so many have come out of the basement workshop and the family garage.

C. N. Brinser

A.S.T.E. President, 1945-46

A Symposium

The Tools and Techniques for the Production of Precision Gears

Installment No. 2, Augmenting the "Know-How" of Modern Gear Manufacture

Bevel Gear Manufacture—the Gleason System

By George Hessler

Continued

Bevel Gear Grinding

In recent years the process of grinding as applied to bevel gear teeth has been extensively developed and today grinding is in many instances the most economical means of producing gears to meet requirements of accuracy and strength. This development is of particular importance in the manufacture of hardened aircraft gears where the requirements of accuracy and uniformity are particularly difficult to meet by any other method. Grinding the teeth provides a practical solution to the problem of manufacturing extremely accurate bevel gears for aircraft applications. In addition, it results in other advantages, notably, smoother finish and accurate blending of the root radius into the bottom of the tooth space and the tooth profile with a consequent increase in strength.

Mr. Hessler

Grinding of the teeth has also solved many problems in the production of precision hardened gears in the industrial field, in precision instrument manufacture, in marine applications and in the machine tool field ground gears are used for accurate generating motions, and indexing mechanisms.

Two types of grinders, a generating type and a Formate type of machine are used for gears up to approximately 24" in diameter. Figure 15 illustrates the generating type of grinder. Both the Formate and the generating machine are fully automatic, the operator being required only to mount and to remove the gear from the machine after the initial setup has been made. The automatic control of the sequence of dressing and grinding and of the feed are of great importance since it results in uniformity of finish and eliminates to a great extent the danger of overheating the work because of careless dressing or excessive feed.

In general, the methods used for finishing the teeth by grinding are very similar to the cutting methods previously described. This is natural since the grinding wheel is similar to the face mill type of cutter in shape. As a general rule, the Formate type of machine is used for grinding by the "spread blade" method. The generating grinder may be used for grinding by the "spread blade" or the "fixed setting" method, depending on the gear design.

The number of passes and the amount of stock per side for grinding depend on the size of the gear, the condition of the gear as to uniformity of cutting and degree of distortion, and the type and hardness of the material used. As a general rule .003" to .004" grinding stock on each side of the tooth is sufficient for nearly all gears within the machine capacity, assuming reasonably good control of hardening distortion.

Grinding gear teeth is not an expensive operation when the work as delivered to the grinding machine is in proper condition. Unfortunately, the knowledge that the teeth of a gear are to be ground is in some cases used as an excuse or a reason for careless manufacturing practices in the operations which precede the grinding operation. In the manufacture of ground tooth gears it is a good rule to follow the same manufacturing methods and to exercise the same care as when the teeth are not to be ground.

Bevel Gear Testing

The most conclusive test of a bevel gear is a running test with its mate, with both members mounted in the same position relative to each other as in assembly. Smoothness

FIG. 15. Gleason No. 17 Gear and Pinion Grinder.

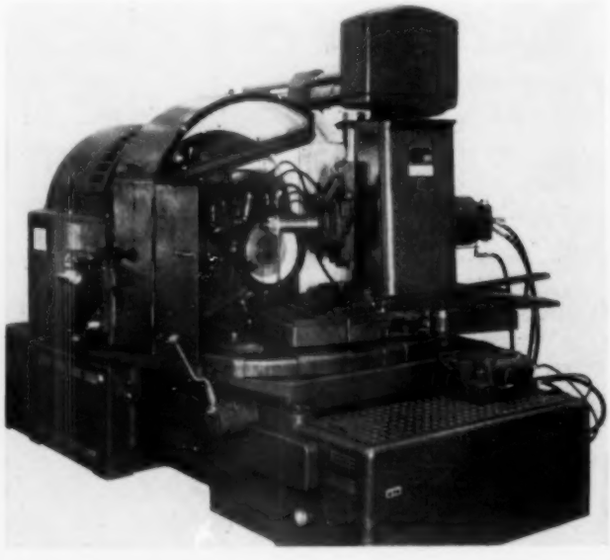


FIG. 16. Gleason No. 13 Universal Tester.

and quietness of operation, type and position of tooth bearing, tooth size, eccentricity and spacing errors can all be checked by this method of testing.

The measuring of involute tooth profile errors and lead errors which is common on individual spur gears is not a practical method for bevel gears because the tooth of a bevel gear varies at every position from end to end and spiral teeth do not have a constant curve. Spacing errors and eccentricity are however measured in much the same manner as on spur gears when it is necessary to determine the exact values.

The testing of bevel gears by running them in their correct operating position is performed on testing machines, built specially for this purpose (Fig. 16). Two general type machines are in use: the right angle machines for testing gears which operate at 90° shaft angle and the universal machines for running gears of any shaft angle. On most machines one of the heads is adjustable vertically for testing hypoid gears and the other head is adjustable in a horizontal plane to handle gears of various sizes and ratios. Power is applied to one (pinion) head with a range of speeds, the driven or gear head being equipped with a brake for applying loads as the gears are run together.

The adjustments which are available on bevel gear testing machines also make them invaluable when developing the gear tooth during cutting, since it is possible to determine the amount and direction of changes necessary in the cutting machine to produce the required tooth contact. These adjustments are very useful in determining the amount and direction of errors in gear housings. The tooth bearing is observed on the gears as assembled in the housing and then duplicated on the testing machine, and the variations from the correct position are noted on the dials and scales on the machine.

Solid hand rolling fixtures are not satisfactory for testing bevel gears with the sole exception that they can be used to determine whether or not the gear being checked has backlash when mounted on correct centers with its mate or mating master gear.

The term "soft test" is commonly used to denote the running test of gears before they are hardened or heat treated. After the gears have been hardened, and lapped, if lapping is required, they are given a final running test which is known as the "hard test." In the case of gears which are not to be hardened after cutting, the soft test is, of course, also the final test.

To maintain adequate control of quality the soft-testing operation should be performed as the gears come off the finish cutting machine. The percentage of gears tested varies in different plants and is affected by several factors, such as quality, cutting method, condition of blanks, and others. When gears are of a precision nature it is usual to soft test and hard test 100%. In any case, the first gear off the cutting machine should always be tested after any change in the cutting conditions has been made, such as a cutter change, machine setting alteration, change in coolant or change in material.

In addition to developing the correct profile and lengthwise tooth bearing for a given pair of gears the testing operation, particularly the soft testing, should also include an inspection of concentricity, tooth spacing, interferences, mounting distance, backlash and tooth thickness. The soft testing operation is emphasized because after the gears have been hardened it is usually impractical to remedy errors which may be discovered in the hard testing operation.

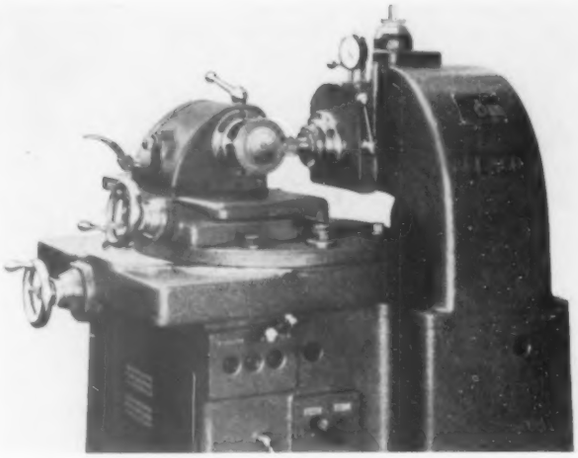


FIG. 17. Gleason No. 6 Angular Hand Rolling Tester.

When testing bevel gears by running, excessive eccentricity is indicated by a progressive variation of the position of the tooth bearing on the teeth, and by a periodic variation in sound in time with the revolutions of the gears.

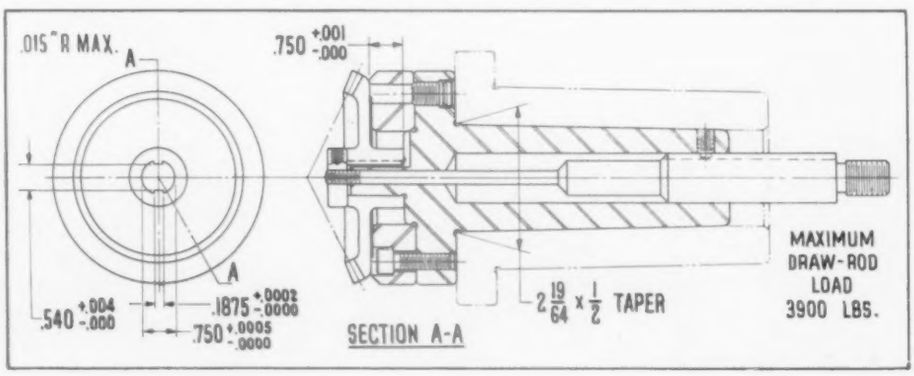
Spacing errors are indicated by a knocking sound when the gears are run together, and by a very light or very heavy tooth bearing on one or more teeth.

Interferences may be detected by roughness and noisy operation and by visual observation after running with a light load. Some of the more common causes are due to teeth cut too shallow, blank machined wrong, root radius too large, and tooth profile not entirely rolled out.

During hardening certain changes occur in the teeth which affect the tooth contact, causing the gears to run best in a position which differs slightly from the position in which the teeth were cut. Except when the mounting distance must be held exact, it is the usual practice to lap and hard test the gears in the best running position. When this position has been determined on the testing machine, the mounting distance and backlash are etched on the pinion member. When assembling the gears in the housing the pinion is mounted as marked and the gear member is then positioned to give the backlash as marked.

In certain types of high precision gear work such as instrument gears and certain other types which are usually required to operate smoothly with little or no backlash, extremely close tolerances on tooth spacing and concentricity must be maintained. In such cases the running test may not suffice, particularly when definite tolerances must

FIG. 18. Typical chucking equipment for straight bevel gear.



be met by measurement. To meet the inspection requirements in this field three devices are used. These are a hand rolling tester, a tooth spacing tester and a concentricity tester.

The hand rolling tester (Fig. 17) is the most useful device for measuring size variations, eccentricity, spacing errors and smoothness of roll. This type of tester is made in two sizes, the larger of which will accommodate gears up to 7½" in diameter, and may be equipped with power for running tests. It functions on the variable center distance principle, the head carrying the pinion being allowed to move a slight amount either side of center. A spring arrangement applies pressure on the pinion head in a direction which maintains metal to metal contact of the pinion with the mating gear. A dial indicator which is actuated by the floating pinion head, records the errors as the gears are rotated. The readings are a composite of a number of errors and some experience is required for their correct interpretation.

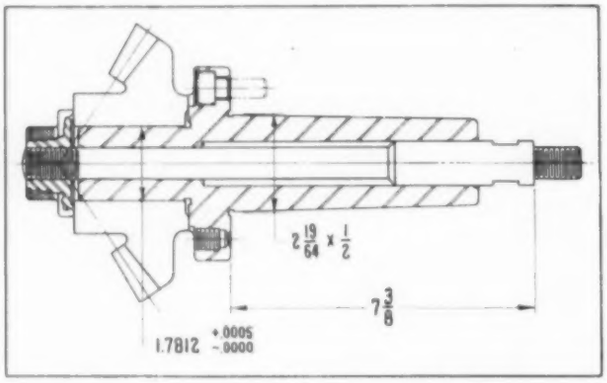


FIG. 19. Bevel gear chuck with support ring for rigidity.

The tooth spacing tester is used for measuring the variation in spacing from tooth to tooth around the gear. It is a fixture with means of positioning the gear in such a way that it can be rotated about its axis. Two fingers, one fixed and the other actuating a dial indicator are mounted on a bracket which rests on a fixed stop when in the reading position. The fixed finger contacting the side of a tooth serves as a stop when indexing the gear while the movable finger contacting a corresponding position on an adjacent tooth actuates the indicator. The indicator is set at zero on the first pair of teeth and the readings on successive pairs of teeth are relative to the first reading.

The concentricity tester is a fixture for measuring the eccentricity of the teeth in relation to the axis of the bore or hub about which the gear is rotated. In principle its construction and operation are similar to the tooth spacing tester. The fixed and movable fingers are however located approximately 180° apart. The difference between the highest and lowest readings in one complete revolution of the gear equals twice the runout or four times the amount that the axis of the teeth is eccentric in relation to the axis about which the gear is rotated.

FIG. 20. Gleason No. 16 Quenching machine in loading position.

Bevel Gear Lapping

Hardened spiral bevel and hypoid gears which are required to transmit heavy loads smoothly and quietly are nearly always lapped unless the teeth are ground after hardening. The lapping machines used may be arranged for manual, semi-automatic, or fully automatic operation depending on production requirements. The lapping compound is a mixture of abrasive and oil which is pumped to the mesh point of the gears.

The lapping operation should be used only as a means of refining the tooth surface and for correction of slight hardening changes, and improvement of the tooth bearing. It should not be considered a salvage operation for the correction of excessive hardening distortion or improper gear cutting nor should it be relied upon to remove runout from gears.

When lapping gears of even ratio it is necessary to identify the tooth of one member with the corresponding tooth space of the other member. In assembly, the teeth should be meshed in the same relative position as when they were lapped.

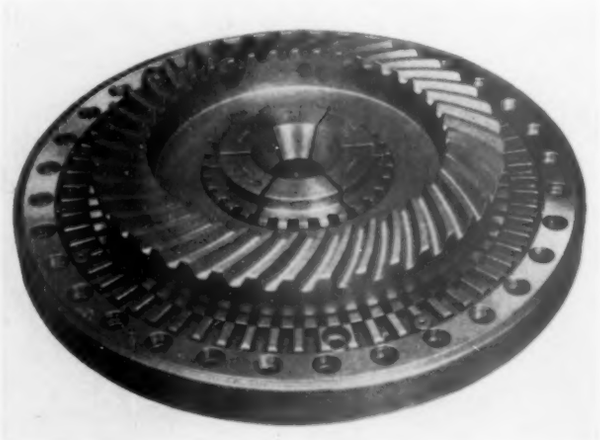
Bevel Gear Chucking Equipment

In the cutting, testing, and lapping of bevel gears of good quality the chucking equipment, which is used to hold the gear while these operations are being performed, plays a vital part. The importance of the holding equipment is frequently overlooked, although it should be obvious that there is no point in using a precision generator having a work spindle of great rigidity, and concentric within a fraction of a tenth of a thousandth, if the work arbor which is placed in the spindle is too flimsy to support the work adequately or is eccentric a matter of thousandths. Many of the difficulties which are ascribed to faulty machine functioning, such as poor finish, spacing errors, and eccentricity are eventually traced to inaccurate or incorrectly designed chucking equipment.

The important points to consider in connection with chucking equipment are rigidity, concentricity, accuracy of size, and an ample, uniform force for holding the gear in place. Excessive overhang, loose bushings, a multiplicity of fits, and equipment which must be trued up on the machine should be avoided. Chucks and arbors should, in general, be maintained within .0002" of the correct size at all times. When mounted in the cutting or testing machine the radial and axial locating surfaces should run true within .0002 full indicator reading. Even closer tolerances are required for gears of extreme precision.

Bevel gear cutting and testing machines are usually equipped with a work spindle having a taper bore which receives the taper shank of the cutting arbor. In manufac-

FIG. 21. Gleason quenching die (lower die shown).



ture, the large end of the bore is held very accurately to size, so that the shoulder of a correctly made arbor will seat on the face of the work spindle, when the arbor is pulled snugly into the taper bore.

To seat properly in the taper bore and on the face of the spindle, the arbor must be made with the correct "draw." The draw is the amount that the shoulder of the arbor is away from the face of the spindle when the arbor is wrung into the spindle by hand. This amount should be from .004" to .012" depending on the size of the taper.

The practice of using arbors which do not seat on the face of the spindle, but locate on the taper only is very injurious to the work spindle, and the bearings carrying the spindle. Constant use of such arbors will eventually cause the taper bore in the spindle to lose its correct size, and if such arbors are pulled into the spindle too tightly it may cause the bearings to lock, with consequent major injury to the machine.

Nearly all modern bevel gear cutting machines are equipped with hydraulic chucks to which nearly all types of work holding equipment may be readily adapted. Hydraulic chucking was formerly used only in the automotive and other high production fields, but the advantages to be obtained through its use have caused it to be widely adopted in small lot production as well.

Some typical methods of chucking blanks for gear cutting are shown in Figs. 18 and 19.

Bevel Gear Hardening

One of the major problems encountered in the manufacture of accurate hardened bevel gears is that of distortion during heat treatment. From the standpoint of dimensional accuracy and concentricity the hardening operation is generally more difficult to control than any other operation, particularly when the gears are of moderately large size and thin section. It is essential therefore that proper processes and adequate equipment be used to keep distortion to a minimum.

Bevel gears which cannot be successfully quenched in an open tank because of excessive distortion are usually quenched in machines which utilize dies for holding the gear to the correct shape during quenching. An upper and a lower die are used, the upper die being carried on a piston which moves in a vertical direction. The lower die which supports the gear is mounted on a bed or lower die holder. After the gear has been placed on the lower die, the piston carrying the upper die moves down and applies pressure on the gear as the quenching oil is forced through the dies.

Except for loading and unloading, the operation of the machine is fully automatic. The quenching time cycle and

FIG. 22. Gleason roller die quenching of shank pinion.

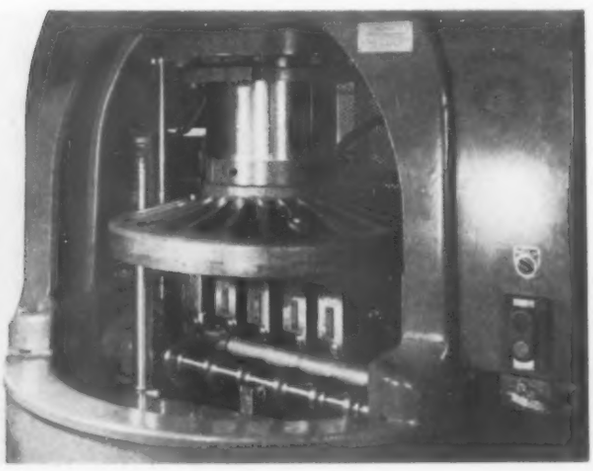


FIG. 23. Gleason No. 1 Surface Hardening Machine.

the flow of oil and pressure of the dies are controllable to suit the conditions required by the type of gear being quenched. Fig. 20 illustrates a quenching machine of this type. A typical lower die is shown in Fig. 21.

When using dies for quenching, it is important that the locating surfaces which are contacted by the die are true and are held in correct relation with each other. These locating surfaces and the surfaces of the die which contact the work must be free from mutilations and other irregularities which would cause the gear to "dish" when the pressure of the dies is applied.

Many gears which are made from carburizing steels are required to have only the teeth and certain surfaces carburized, all other surfaces being required to be soft. To meet this requirement, two methods are in general use. One is the copper plating method by which all surfaces which are required to be soft are protected from carburizing by a suitable copper plate immediately before carburizing. By the other method the carbon penetration is removed from the areas which are required to be soft by machining after carburizing, but before quenching, sufficient stock having been allowed for this purpose. The copper plating method is generally preferred from the standpoint of quality and economy.

When gears are to be quenched in dies, the practice of machining after carburizing is definitely discouraged when such machining affects the locating surfaces which are contacted by the dies when quenching. This is because the gear as it comes from the carburizing is generally in a more or less distorted condition and the machining of the locating surfaces with the gear in this condition cannot make these surfaces true with the teeth. The quenching dies will hold the locating surfaces round and flat, but this will be of no benefit insofar as the teeth are concerned unless the locating surfaces were true with the teeth before heating for quenching.

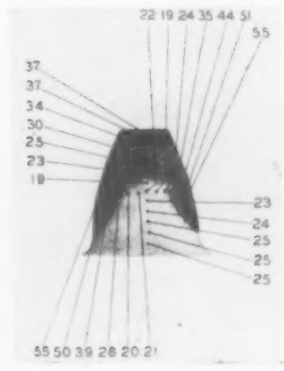


FIG. 24. Section of Surface hardened tooth with Rockwell readings.

In certain types of gears with shanks the practice of straightening after quenching is objectionable for metallurgical reasons. To eliminate the need for straightening work of this type, a roller quenching die arrangement is used with excellent results. The heated work is placed between rollers mounted on the upper and lower die holders which rotate the work as it is submerged for quenching. Fig. 22 illustrates this type of quenching die.

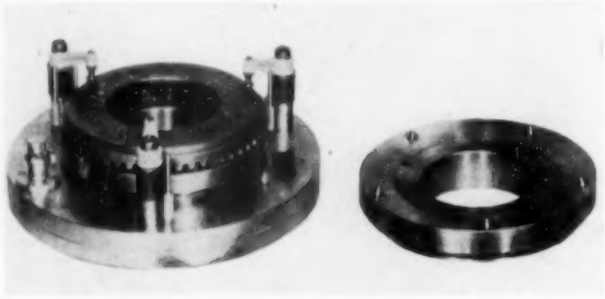


FIG. 25. Typical pitch line chuck.

A gear hardening process which has been widely adopted is the localized surface hardening or flame hardening of gear teeth by means of an oxy-acetylene flame. By this method individual teeth of a gear are hardened by oxy-acetylene heating tips which heat both sides of a tooth simultaneously as they travel along the length of a tooth. No appreciable distortion can be discerned in gears hardened by this method, when the process is properly applied and in practically all cases it is safe to finish all surfaces of the gear to the final sizes before surface hardening. However, to attain accurate results and uniformity it is essential that machines, having the necessary adjustments for speed and direction of burner travel, be used. Surface hardening by hand is impractical because of the danger of burning and lack of uniformity of the hardening.

Two machines are used—one for gears up to 24" in diameter which is fully automatic, the other for gears up to 120" in diameter on which the indexing from tooth to tooth is manual but all other motions are automatically controlled. Figure 23 shows the automatic machine.

The surface hardening process is intended primarily for hardening the working surfaces of the teeth to increase the wear life of the gear. The hardening does not affect the core properties. (See Fig. 24.) When it is necessary to have a specific core strength for load carrying capacity, the gear blank must be heat treated to the required properties before finish machining.

Grinding Mounting Surfaces

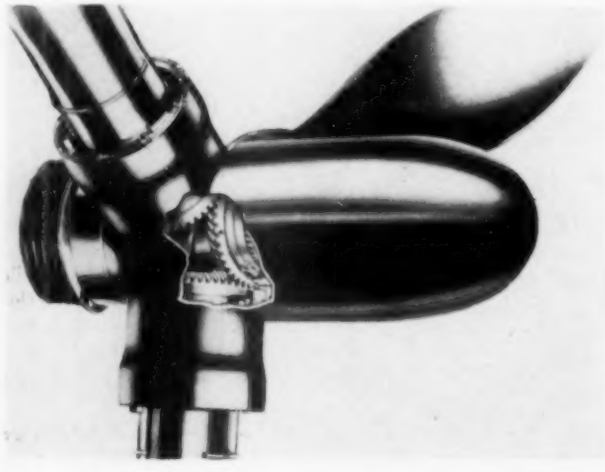
One of the most important operations in the manufacture of accurate, hardened bevel gears is the grinding of the bores, bearing diameters, and axial surfaces which are used for mounting the gears in the final assembly. Unless the teeth are to be ground, the concentricity of the teeth with the mounting surfaces and consequently the functioning of the finished gears are largely controlled in this operation. It is essential then that correct methods and tooling are used where finished gears of good quality are required.

There are several conditions, some of which are beyond the control of the grinder operator, which make it difficult to grind the mounting surfaces true with the teeth. Among the most common are, excessive hardening distortion, improper grinding fixtures, and improperly located or incorrectly machined reference and locating surfaces for positioning the gear for grinding.

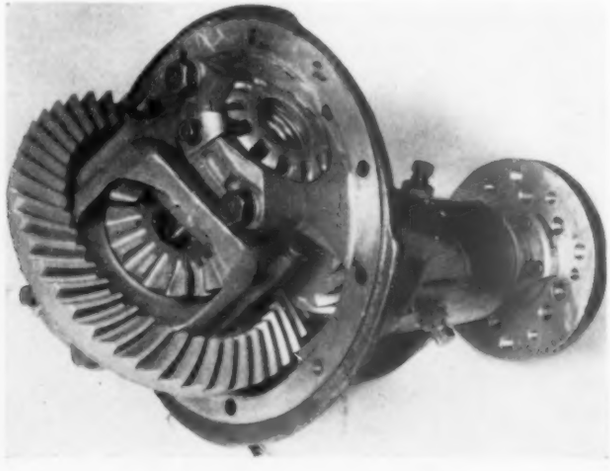
In small lot production it is not always economically practical to provide special fixtures for holding the gear when grinding the bore. In such cases it is necessary to machine axial and radial reference or proof surfaces on the gear blank for indicating purposes when grinding. As a general rule the locating or reference surface, both radial and axial, should be as near to the teeth as possible, so that when the gear is chucked for grinding with the locating surfaces running true, the teeth will be correspondingly true. When the locating surfaces are adjacent to the teeth, any distortion in the area containing the teeth will be reflected on the locating surfaces. This makes it possible to readily measure the amount and direction of the distortion and aids in positioning the gear in its true position for grinding. When the locating or reference surfaces are in an area remote from the teeth, there is danger of the teeth running out even when the reference surfaces run true.

The fixtures for holding gears for grinding the mounting surfaces vary widely, depending on the size and shape of the gears and the quantity to be manufactured. They range from the simple chucking plate with straps to the highly efficient pitch line chuck which locates the gear directly by the teeth. Among such fixtures are the common jaw chuck, the collet chuck, the removable locating plug, fixtures which locate the gear by the face or back angles, and many others to suit particular conditions. All these fixtures must satisfy the one prerequisite, that they position the gear in such a way that the teeth run true axially and radially.

Gleason Zerol bevel gears for airplane controllable pitch propeller.



Gleason automotive differential carrier with hypoid main drive ring gear and pinion and straight bevel differential gears.



The most satisfactory type of fixture from the standpoint of efficiency and accuracy is the pitch line chuck which locates the teeth directly by the tooth profiles. It eliminates the necessity of machining reference surfaces on the blanks and since the gear is located by the teeth, no trueing up is necessary which permits the use of operators relatively unskilled in the grinding of gears. Such a chuck is shown in Fig. 25.

It must be emphasized, however, that the use of pitch line chucks in no way eliminates the necessity of correct manufacturing processes preliminary to the grinding operation. The idea that a pitch line chuck line will compensate for poor machining and hardening is erroneous and must be discouraged. The pitch line chuck is an extremely useful and necessary tool in the production of accurate hardened gears, but it must be considered that its primary purpose is to position gears in the most concentric position for grinding and that any errors inherent in the gear because of poor cutting and hardening must always remain in the gear.

(End)

Cross Axis Gear Shaving

By Charles R. Staub

Before the advent of crossed axis shaving it had been the practice to finish cut teeth on gear blanks by a tooth generating operation wherein the cutter or hob and the gear blank are rotated in timed relation to each other. The gradual development of such generating machines and tools have materially reduced characteristic errors in tooth profile and spacing. Nevertheless, owing to variations in materials and grain structure in the gear blanks, and also because of inherent machine errors such as cumulative errors in gear trains, lead screws, bearings, and improper mounting of generating tools, the spacing and profile of the gear teeth were not entirely uniform with the result that gears were not sufficiently quiet. The discovery and development of crossed axis shaving solves the problem.

Charles R. Staub **learned tool, die and gage making in Tiffin, Ohio, later supplementing practical experience with engineering training. After spending a number of years with Ford Motor Co., Detroit Gear & Machine Co., and Chrysler-Dodge Transmission Div., he joined Michigan Tool Company where, for the past 17 years, he has been Chief Engineer specializing in gear cutting, shaving, lapping and finishing equipment. He is a member of the executive committee and vice-chairman of the general engineering committee, AGAM. He is also active in standardization work and has presented a number of papers before ASTE Chapters.**

Major cause of noise, in gears, is an accumulation of errors in contour, spacing and eccentricity, even though measured only in ten-thousandths of an inch. Usually, the elimination of these errors not only produces quiet running gears, but increases their life in service.

There are cases, on record, of thousands of gears that have been hobbed or shaped to finish size, and then rejected at final inspection because they were beyond permissible tolerances for smoothness of roll. These same gears were then shaved on a gear finishing rack, without changing their size any more than .0005 on pitch diameter, and were better gears than the regular run because, by this method, conjugate tooth form had been produced and a much smoother finish obtained.

FIG. 1. "Michigan" rack type gear shaving machine.

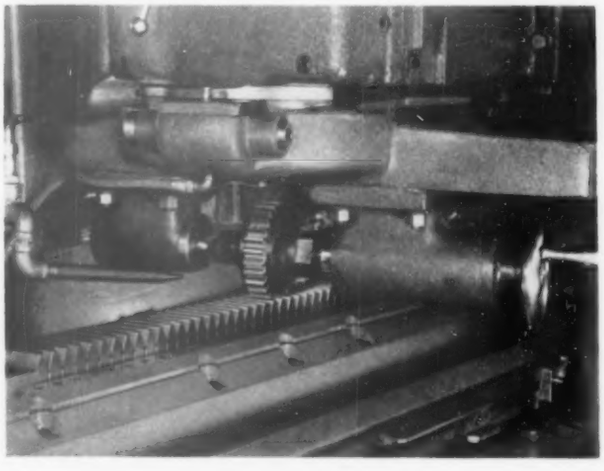
PRINCIPLE OF OPERATION OF GEAR SHAVING

In crossed-axis shaving, gear teeth are finished by rolling the gear relative to a rack or rotary cutter while the gear and cutter or rack are moved laterally relative to each other with their axes askew.

Shaving is a method of removing metal from the contours of the gear by cutting, and is not a cold working process. The metal cuttings removed by this method, when examined under a glass, are found to be minute, curled chips. Either the Rack or Rotary method produces extremely accurate gear teeth, principally because of the accuracy that can be built into the finishing tools. Furthermore, with the work on live centers, and no indexing mechanism—i.e., with the tools themselves driving the work—machine errors and their influence on gear accuracy have been practically eliminated.

For best results, accuracy of gear blanks and the condition of material are determining factors. The material should be

FIG. 1A. Detail of cutter head.



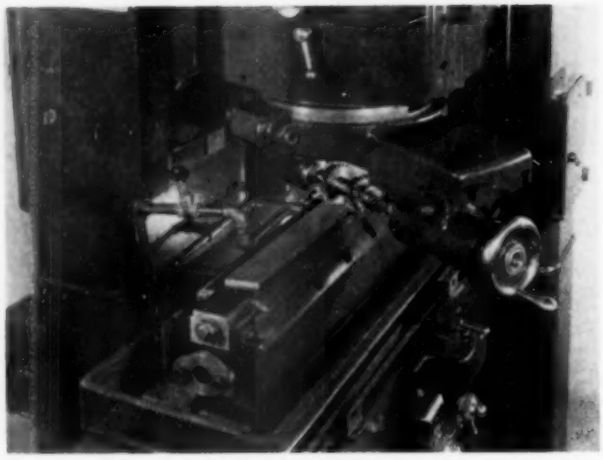


FIG. 18. Detail of rack type shaving machine.

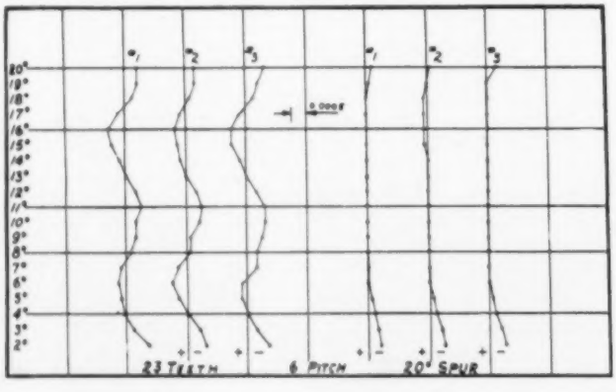
held between 25 and 30 Rockwell "C" scale, and very close attention should be paid to the quality of the gear blanks, including hole size and face runout. The face runout should not exceed .001 on gears from 2½" diameter up to 8" diameter and gears smaller than 2½" diameter and with small holes should be held within a few ten-thousandths.

The process is suitable for shaving helical and spur external gears, and spur and helical internal gears. With it, it has become possible to rapidly finish gear teeth to a higher degree of accuracy than has ever been possible before. Such good results have been obtained by shaving, in industry, that most engineering departments are paying closer attention to design so that all gears will lend themselves more readily to the shaving operation. This applies to aircraft engineering as well as to automotive engineering.

As mentioned, there are two methods of finishing, rack and rotary. In the rack type of gear finisher, as shown in Fig. 1, the working surfaces of the teeth of the basic generating rack are provided with a plurality of narrow parallel grooves separated by narrow lands, the edges of these lands forming parallel cutting edges. The cutting edges are vertical in the normal section of the rack.

The rack is mounted on the table of the machine, which reciprocates similarly to a planer table. The gear to be finished is mounted on live centers, or, on hydraulically operated centers which are used in a good many cases to speed up the loading operation. The head is swiveled so that the axis of the gear is set at an angle with the rack. The correct crossed-axis angle is the difference between the helix angle of the rack and that of the gear, except when both are of the same hand. Then, it is the sum of the two helix angles.

FIG. 2.



Straight type racks can be used for finishing both right and left hand helical gears up to 30 degree helix angle. With greater helix angles, an angular rack must be used, either right or left hand as required. With the rack blades set straight across and since the rack travels in a plane at an angle to the axis of the gear, the result is a constant shaving action between the cutting edges of the rack teeth and the gear teeth being finished.

In Fig. 2 is shown a graph chart of a six pitch, 20 degree pressure angle gear that was semi-finish hobbed in one cut and then shaved on the rack type shaving machine. The left side of the chart shows the check on contour of the rough cut gear and the right side of the chart shows the same gear after shaving. The gears produced are concentric, uniformly spaced, and have an accurate profile. Moreover, every gear will be exactly the same size on pitch diameter. Normal or base pitch will always be correct since the basic rack cannot finish gears otherwise. This is largely responsible for the fact that rack shaved gears are consistently quiet. Another contributing reason is that the gear being shaved with a rack is in area contact with the shaving tool, thus affording better control. The rack type shaving machine can also be equipped with a crowning attachment if desired.

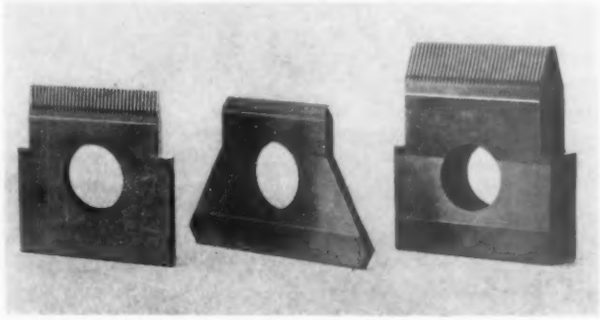


FIG. 3. Typical rack blades.

Fig. 3 shows the general design of a rack blade. The thickness of the blade equals the circular pitch of the gear. All blades are lapped to exact size for thickness and parallelism. Blades may be sharpened a number of times during the life of the rack. More than 1,000,000 gears have been finished with a single rack.

Another advantage of shaving is its economy. The tool cost per gear, when shaving by the rack method, is less than a half cent. Machine operators do not have to be experienced as the machines are very simple to set up and operate. If it is necessary to reduce sizes on pitch diameter one thousandth or more for backlash, the gears can be recut in less than a minute's time without scrap, something impossible by any other method.

The shaving process is used almost 100% in the automotive field, and very extensively on turbine and reduction units, as well as aircraft engine gears and instrument gears. In the aircraft field, shaving did a lot to speed up gear production. Most of their gears were formerly ground—a very expensive operation. On some gears which still have to be ground, grinding could be avoided if more thought were given to design, materials specifications, processing and heat treating, thereby reducing to a minimum the distortion which occurs in hardening. A good point to remember is that aircraft gears are not ground to obtain quietness of operation, but rather to obtain accuracy.

However, accurate gears are also invariably quiet. It is the accuracy which is important, and it is a fact that an accurately finished, heat treated gear of about 38 to 40 Rockwell "C" scale will outwear a hardened inaccurate gear.

The importance of paying close attention to gear steels and their treatment cannot be stressed too greatly. The trouble in the past has been that too many people have been of the opinion that high quality in gears is dependent almost entirely on the equipment and personnel of the gear department. We will grant that this is true to a great extent, but the task of making good gears can be made a lot easier if strict attention is paid to the processing of the gear steels. By that, is meant that every heat of steel should be tested for physical properties and grain size. Forging heats should be held, and forging dies kept in good condition so that the flow of metal is uniform. Normalizing heat should be held within the proper range and, last but not least, gears should be hardened and quenched at the proper temperatures.

ROTARY GEAR SHAVING

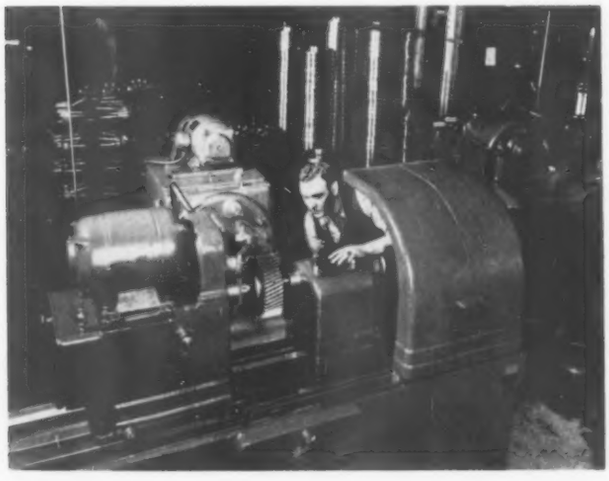
In the rotary method of shaving, the rotary shaving cutter is a gear-like tool having a plurality of teeth conjugate to the teeth to be produced on the gear to be finished. The working surfaces of each of the teeth of this tool are provided with a plurality of narrow parallel grooves separated by narrow lands, the edges of these lands forming parallel cutting edges. The cutting edges extend vertically from the roots of the teeth to their crest. (See Fig. 4.)

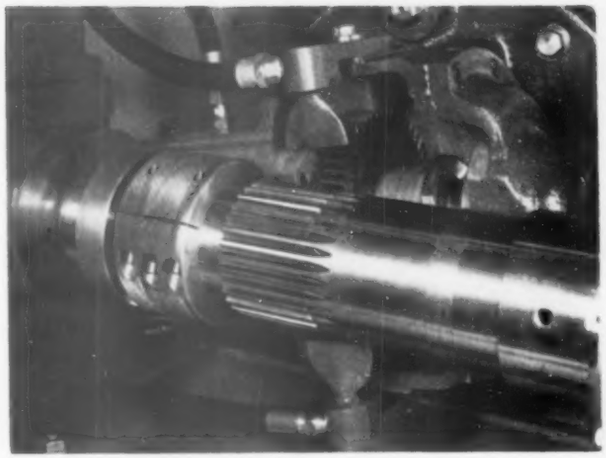
Developed principally for job lot gear production, rotary shaving is also useful for finishing gears that have too much interference to be finished by the rack method, as in the case of closely designed cluster gears.

One of the most important developments, in rotary gear shaving, is the "underpass method." By using this method gears with very small crossed axis angles can be shaved without danger of breaking the cutters. Very good finish is obtained by special designs of cutters for both Underpass and Parallel shaving, which have added greatly to their cutting ability. "Underpass" shaving is performed much more rapidly than other methods of rotary shaving.

FIG. 4. Rotary gear shaving cutter.

"Michigan" rotary gear shaving machine.





Typical rotary shaving application.

These machines are available with a gear crowning attachment if desired. Gears can also be crowned by grinding the crown in the cutter when the underpass method is used, providing the face width of the gears is not too great. Cutters used in this method of crowning are made slightly wider than the face width of the gear. A feature of this method of crowning is that the machine is very easy to set up. The cycle time is also much faster than in other crowning methods. Even automotive helical gears are now being crowned by this method with as high as 110 gears per hour produced per machine.

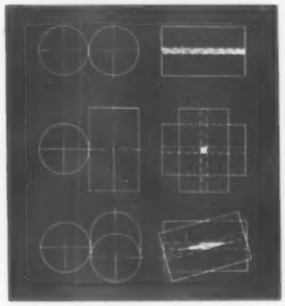
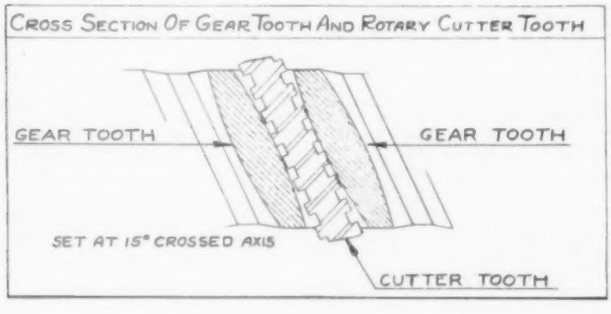


FIG. 5.

It should be pointed out that the circular type of shaving tool is restricted to a smaller shear angle than the rack. This is due to the fact that, when a spur type cutter is in mesh with a helical gear, and inasmuch as they are cylindrical in shape, the contact area between them is greatly reduced because of the angular positioning and relative curvature of the two surfaces in contact. The effect of this characteristic for different angles is shown in Fig. 5.

At the top is shown the contact between two cylinders or two spur gears on parallel shafts. The center sketch illustrates the contact between the same two cylinders with shafts at right angles, while the lower sketch shows the cylinder set at a shaft angle of 15°. A similar contact exists when a spur type cutter is meshed with a helical gear. Fig. 6 shows a cross section of a gear tooth and a cutter tooth in mesh with their axes crossed at an angle. This section is taken in a plane tangent to their pitch diameter.

FIG. 6.



The angular setting of tool and work axis of course have a distinct bearing on the cutting action of the tool and the finish that can be obtained. The greater the relative angularity of the axis, the greater the cutting efficiency. If carried too far, however, there is danger of losing control of the product, thereby affecting quality due to the fact that the contact area has been reduced to the danger point, as has been illustrated in Fig. 5. We have found that on wide face gears the optimum of cutting angle and control is attained by using approximately 10° crossed axis.

For the average run of gears, the most efficient shear range is from 12° to 15°, but where clearance is limited, shear angles as low as 3° have been used. Even with so small an angle, gear quality is still superior to that obtained by finishing with either the hobbing or shaping process.

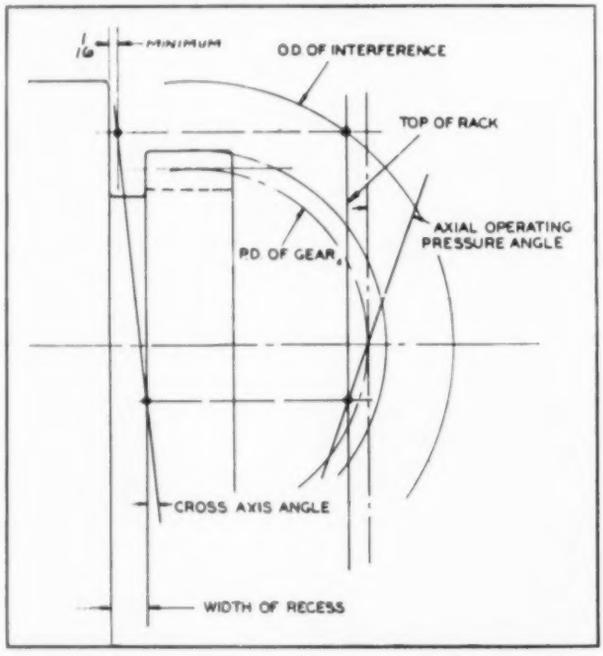


FIG. 7—Above.

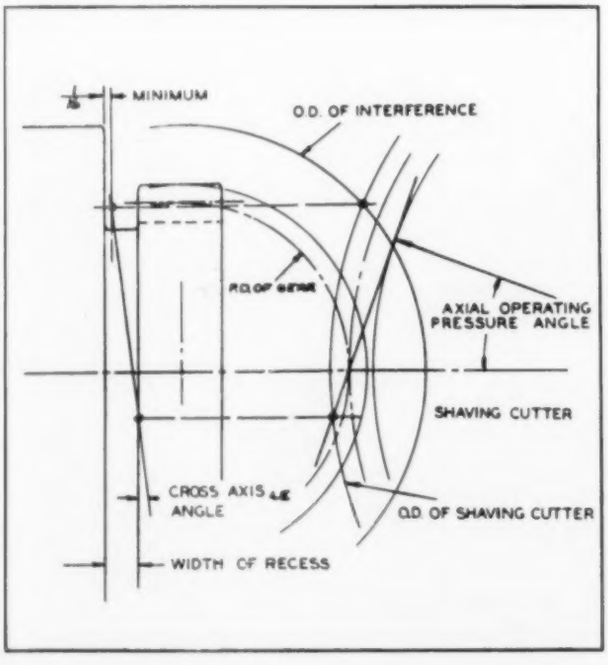


FIG. 8—Below.

Fig. 7 shows the method of procedure to determine the crossed axis angle for shoulder work when gears are to be shaved by the rack method, and Fig. 8 the method used to determine the crossed axis angle used for shoulder work when shaving by the rotary cutter process. The effect of axial feed of the gear during rotary shaving is illustrated in Fig. 9. The upper sketch shows stock removed without axial feed of gear. The lower sketch shows the same gear tooth when an axial feed has been employed to the extent of 5/16 axial travel.

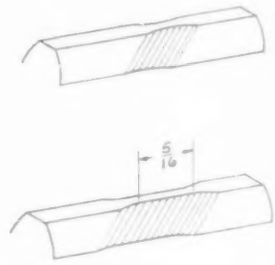


FIG. 9.

Fig. 10 shows how the crossed axis pivot point of the cutter should be placed in relation to the gears being finished on both plain gears and gears having interference. This pivot point must pass beyond both faces of the gear in order to properly finish the teeth to the full width of the gear. Spur type shaving tools can be used for finishing both right and left hand helical gears up to 15° helix angle. With greater helix angles, right and left hand helical shaving tools must be used.

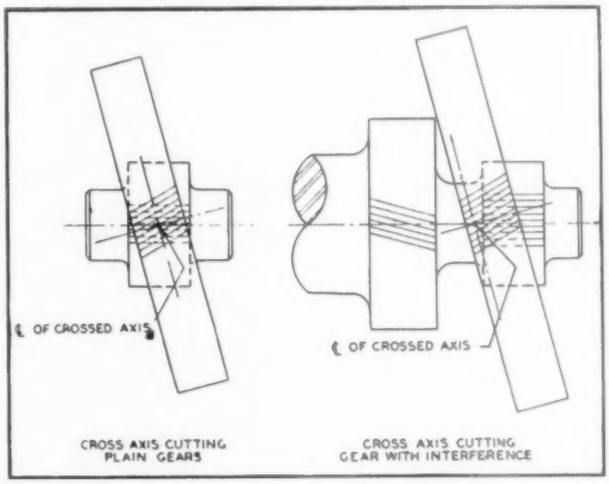


FIG. 10.

REQUISITES FOR SHAVING

In shaving gears by either the rack or rotary method, it is necessary to semi-finish cut the gears deeper than standard depth in order to avoid interference between the tips of the rack blades or the rotary cutter teeth with the fillet at the base of the gear tooth. This depth is usually figured $\frac{2.35}{\text{N. D. P.}}$. It is sometimes necessary to use a hob or cutter having a protuberance at the tip, as shown in Fig. 11, in order to avoid interference. The total depth of cut, however, is calculated in the same manner.

It is very important, in designing gears, to be sure that they have sufficient involute overlap as to teeth in contact as well as sufficient helical overlap. It is equally important when shaving gears by either method to be sure that there is sufficient overlap for carry-over in order that cutting action may be continuous. There seldom is any difficulty with this however, except in the case of involute spline shafts or gears of small diameter or short stub teeth.

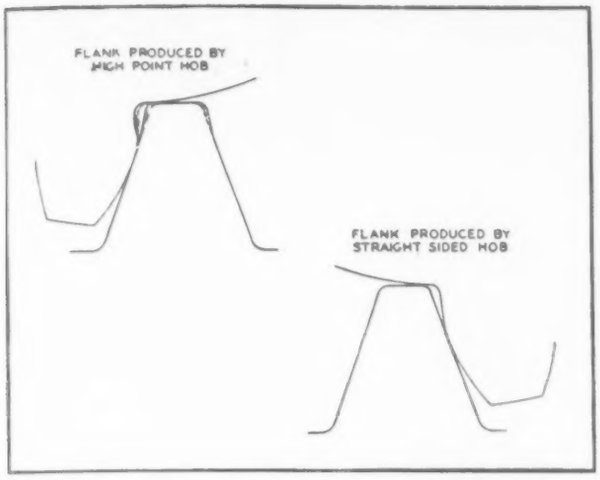


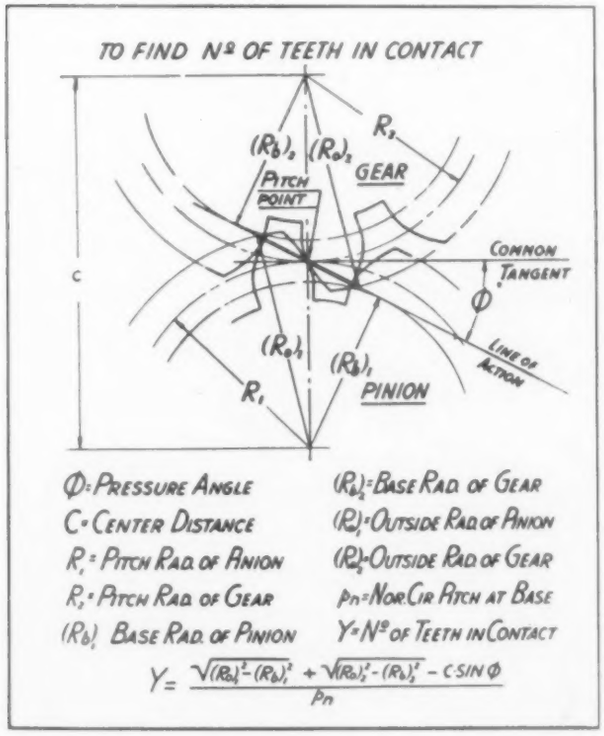
FIG. 11. Note protuberance, upper left.

Fig. 12 shows a method of figuring the number of teeth in contact for external gears, and Fig. 13 shows a method of figuring the teeth in contact or involute overlap with an internal gear and pinion.

One of the requisites for high quality in shaving is to have the semi-finished gears come to the shaving operation with a uniform amount of stock. The charts and instructions given in Fig. 14 should be used as a guide, in determining the amount of stock that should be left for shaving. This chart is intended for gears shaved at a crossed axis angle of from 10° to 30°. On gears shaved with smaller crossed axis angles, proportionately smaller amounts of stock should be left for shaving.*

Measurements given in this chart are micrometer readings over two pins, over and above the finish size of the gear to be shaved. This chart is calculated to be used with pressure angles between 14½ and 24°. Cutting depth for pre-shaving tools of 20 diametral pitch and finer should be according to the A.S.M.A. Fine Tooth Standard. The recommended depth as stated before for other pitches is 2.35 over D.P. or 2.40/D.P., depending upon conditions. Where gears are to be shaved, Class "B" semi-finishing tools can be used

FIG. 12.



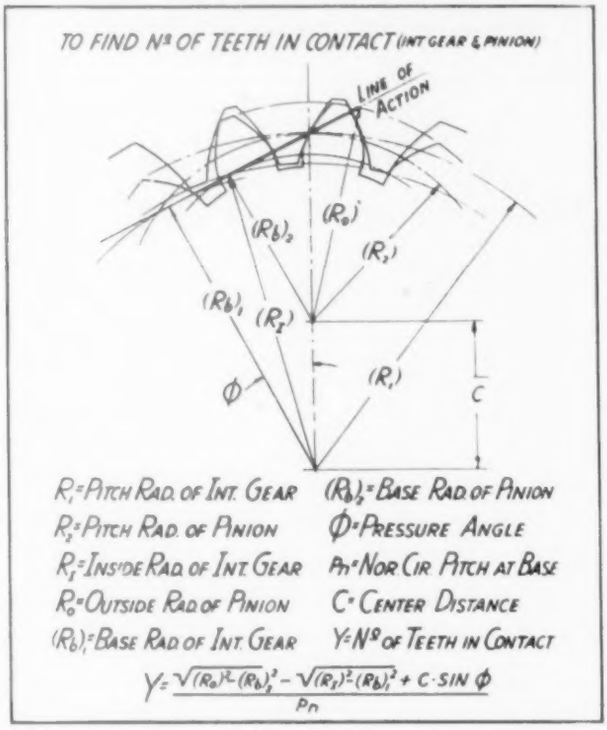
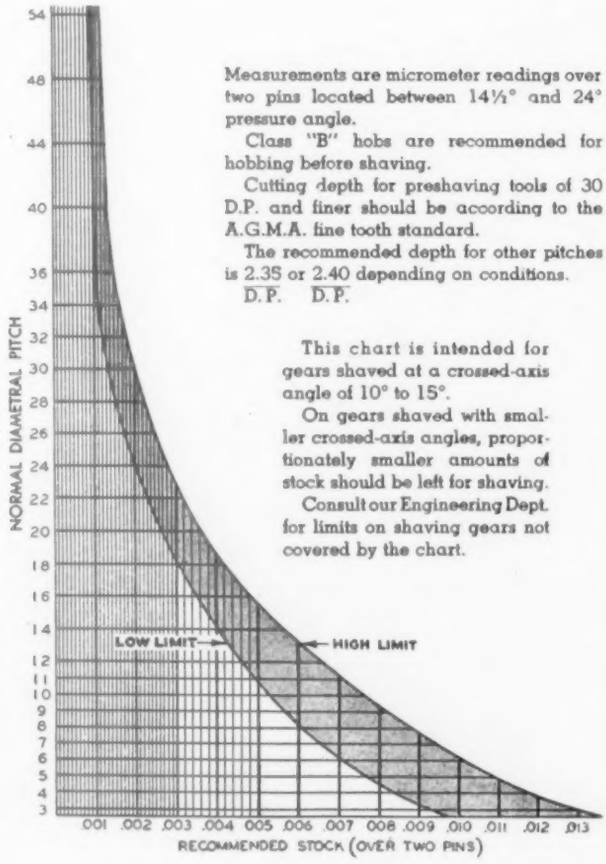


FIG. 13—Above.

FIG. 14—Below.



and the semi-finishing operations speeded up over and above that when gears are to be finished either by the hobbing or shaping process. Inasmuch as Class "A" tools must be used when finishing by hobbing or shaping, there results a considerable saving, both in cycle time and tool cost.

*It is recommended that Michigan Tool Company's Engineering Department be consulted for limits on shaving gears not covered by this chart.

A supplementary article by Mr. Staub—Gear Lapping—will appear in the March issue, THE TOOL ENGINEER.

The "Shear Speed" Gear Shaper

by Gunnar Skog

ONE OF THE FACTORS in mechanical progress is that, as some new method markedly increases output, it immediately upsets the balance of production. As an example of balance, three machines—one roughing, one semi-finishing and one finishing—may be set up in a manufacturing sequence. Each keeps pace with the others, the whole presuming an even flow of material in process.

Say, now, that a new machine is installed for roughing, and that its output is twice that of the machines used for the latter operations. These machines then create a bottleneck, impeding the flow of material. To keep the new machine fully employed, then, it would be necessary to multiply the equipment used for the succeeding operations in direct ratio to the increased output of the first machine. Thereby, balance would be restored.

Inversely, the last machine—i.e., the one used for finishing—might be replaced with one capable of many times previous output. But, unless it could be supplied in ratio to output, it would be no more efficient, as far as production is concerned, than the one it superseded. To effect a balance, one would either install more of the slower roughing and semi-finishing machines, or, preferably, provide new machines equal to the finisher in potential output. Progressive tool engineers would incline to the latter alternative.

The situations stated above are apropos the development of crossed axis gear shaving machines and gear lapping machines, each of which, until recently, was capable of output far beyond that of the machines used for the preceding roughing or finishing operations. To effect a balance, it was evident that a new machine must be developed, for semi-finishing gears, that would keep pace with the much faster shaving and lapping operations.

The answer to the problem was the "Shear-Speed" Gear Shaper, a new machine recently introduced by Michigan Tool Company, Detroit. This machine, with which all teeth in a gear are cut simultaneously, is as radical a departure, from conventional gear cutting equipment, as the original gear shaper of several decades ago. It makes possible the removal of enormous amounts of stock in a very short time.

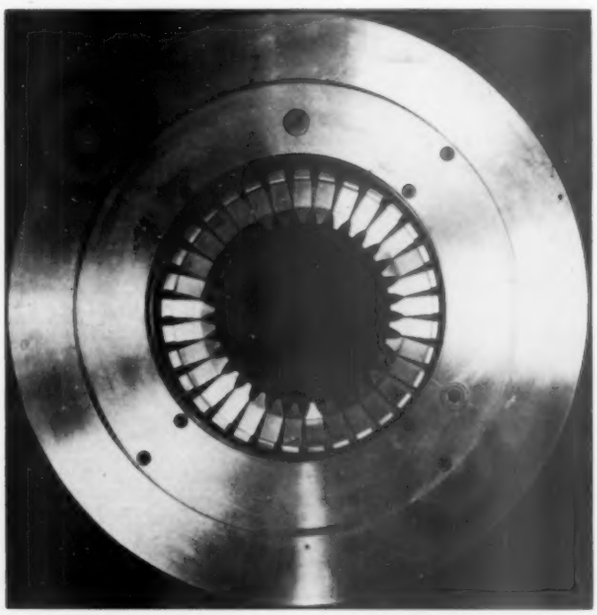
As implied, the purpose of the machine is to rough and semi-finish gears at a rate comparable to that of shaving. And, in actual production, it has been demonstrated that one Shear-Speed shaping machine will keep approximate pace with a shaving machine. That is, one of each will produce about a given number of finished gears, in predeterminable quantities, in a given length of time. If necessary, both machines may be operated by one man.

As another departure from the conventional, the gear, rather than the tools, reciprocate. The gear to be cut is mounted on a work holding adapter which usually is held by and works in conjunction with a hydraulic clamping device. The latter interlocks with the automatic machine cycle to provide a rapid and secure means of holding the gear while the teeth are being cut.

In operation, the tools (inserted in a cutter head) are held stationary except for relief and feed movement, while the gear reciprocates vertically, with guide control for either straight or helical gears. Stroke is adjustable, and actuated and controlled by a crank, one revolution of which is equal to a complete cycle which, in turn, may be divided into four parts—the cutting stroke, the relief movement, the

FIG. 1. Michigan "Shear-Speed" gear shaper.

FIG. 2. The "Shear-Speed" cutter head.



return stroke and the in-feed movement. The movements for relief and in-feed occur at the top and bottom of the stroke, respectively, with the tools held stationary during the up and down strokes. See Figs. 1 and 2.

The crank also drives the feed ratchet which, in turn, rotates the feed cam. The latter is divided into several stages, decreasing the amount of feed as the cutting blades approach the proper depth. A few finishing strokes, without in-feed, take place, at the end of the feed movement, the whole more or less comparable to the "spark-out" strokes in grinding.

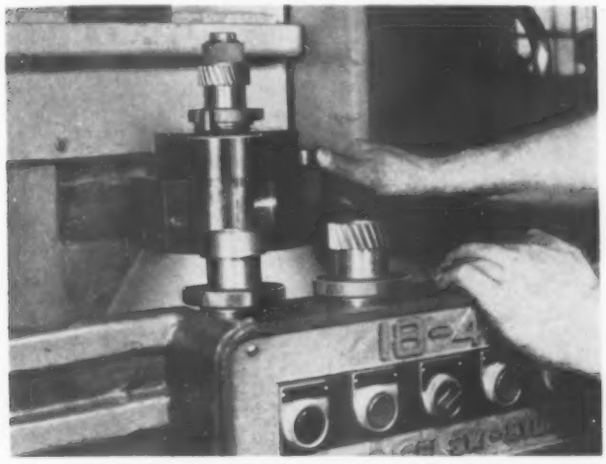


FIG. 3. Head raised for loading.

To complete the machine cycle, the cutter head is raised 10 inches, this allowing ample clearance for the removal of the gear. See Fig. 3, in which the machine is set up to cut a helical gear of 27 teeth, 12 pitch, 20° pressure angle, with helix angle 17°, 49′, and lead 19.8″. Here, the gear is mounted on a hand-operated fixture instead of on a hydraulic, such as is shown in Fig. 1.

The cutting tools—or blades—used on the Shear-Speed shaper are of high speed steel, with the form of the space between the gear teeth ground on the cutting edge of the blade. End clearance is of course provided, with the body of the blade ground and lapped to a high degree of perfection. The blades are held in correct relation to the gear being cut by a hardened and ground slotted head, the number of slots being determined by the number of teeth in the gear. All this is shown in Fig. 5. Feed movement of the blades is controlled by an angular projection, on their ends, which is held between two conical shaped members. Fig. 6 shows an assembly of the cutter head, viewed from the under side. The conical shaped members of the cutter head, referred to above, are held in position on the machine by a ram mounted on vertical slides. See Fig. 7.

FIG. 4. Hydraulic jacks facilitate head interchange.

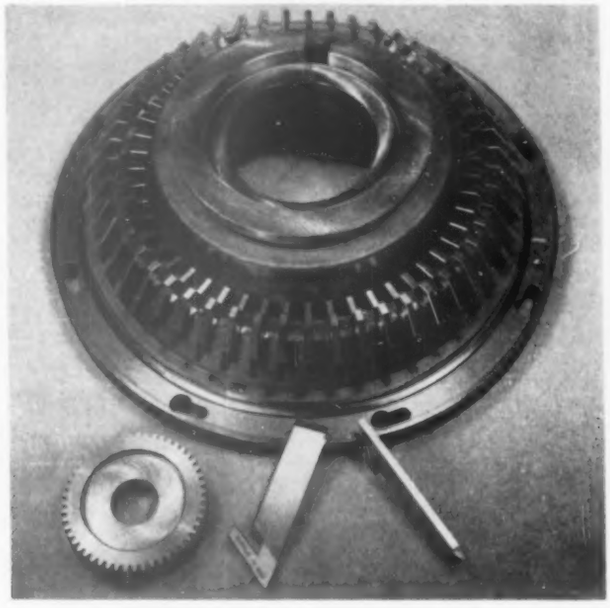
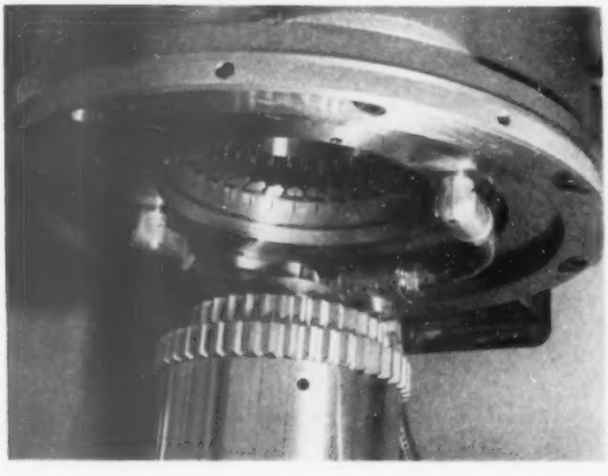


FIG. 5. Cutter head and blades.

When it is necessary to remove and replace the cutter head—as when blades are to be sharpened or when a different size or type of gear is to be cut—removal is accomplished by loosening the eight screws shown in Fig. 2. These screws release the clamping ring which is provided with bayonet slots. The clamping ring is then turned clockwise, freeing the head, which is then lowered in position as shown in Fig. 4. The head, which weighs about 70 pounds, can be removed by one man who can effect a complete change of heads in considerably less than 30 minutes. Should it be required to change over from cutting spurs to helicals, it would also be necessary to replace the spur guide with a

FIG. 6. "Worm's-eye" view of cutter head.



helical guide. That would imply a complete change-over taking several hours.

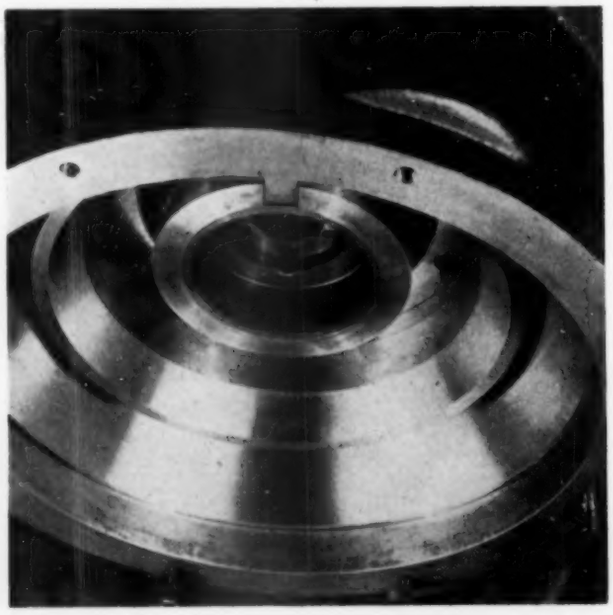
Jacks, so designed that they are easily attached to and removed from the machine, are provided to facilitate quick removal and replacement of the cutter heads. See Fig. 4. In fact, every possible provision has been made to reduce down time to a minimum. Down time may be further reduced through the use of duplicate cutter heads, when one head would be in use while blades for the other are being resharpened and reinserted.

Due to the high output rate of the machine, considerable thought has also been directed, in its design, to safety of operation. To start the automatic cycle, it is necessary to press both outside buttons shown in the panel, Fig. 4. This two-hand control prevents the operator from getting a hand caught in the machine. The button immediately at right of center stops the automatic cycle, and the button, left of center stops the main motor drive. With the center switch turned to the right, the machine is in regular running position; however, this switch may also be set so that all buttons become job buttons. As a further safety feature, the machine cannot be started until all guards are properly closed.

Last, but not least of the features of the machine, is its productive capacity, and this can best be compared with modern gear cutting practices. Cutting time depends only on the face width and the pitch of the gear to be cut although, in this connection, several narrow face gears may be stacked, when all are cut together. Since all teeth are cut simultaneously, their number is not a consideration. It follows, however, that a narrow face gear would imply a shorter stroke than one with wide face, with proportionate less time required for cutting. However, several narrow gears may be stacked, thereby reducing loading time. Also, a fine pitch gear would not require as many in-feeds as one of coarse pitch.

As a specific example, a 7 pitch gear of 22½° pressure angle, 33 teeth and ⅞" face width formerly required fourteen conventional gear cutting machines to produce the required output in an eight-hour day. Yet, a single Shear-Speed shaping machine produced the required number in 6.2 hours—and the machine was operated by one man who also operated a gear shaving machine.* The actual cutting time of the gear described was 44 seconds.

FIG. 7. Conical members of cutter head.



Very satisfactory tool life is said to be obtained with the high speed steel tools used. As a random example, about 400 cast iron gears, 2" face width, have been averaged between sharpenings. Since about .020" is removed from each blade, when sharpening, giving a tool life of about 18,000 gears per set of blades. On S.A.E. 4027 carbon molybdenum steel gears, having a Brinell hardness of 150, 200 gears are obtained per grind, with only .0008" removed per sharpening.

*A Michigan Tool Co. Gear Shaving Machine referred to; however, it is implied that the Shear-Speed gear shaping machine would supply, at comparable speed, any of the contemporary gear shaving machines if of equal productive capacity.

Carbide Hobs Enhance Quality and Production

by George P. Maurer

CEMENTED CARBIDE cutting tools are now being used on such a variety of cutting operations that their application for increased production is in many cases considered routine tooling procedure. However, the successful application of carbides on special cutting operations requires full and complete knowledge of the basic principles involved as well as the more practical concepts of machine limitations and operation. It is, therefore, not surprising that, during the past two years, considerable attention has been focused on the carbide hob as a means of increasing the production of all types of gearing.

George P. Maurer **was graduated from Marquette University, College of Engineering, in 1930. Joining the Falk Corp'n, as a cooperative student employee in 1926, he has subsequently served as development engineer and since 1940, Supervisor of Gear Precision. He is active in A. G. M. A. and, at present is ch'man of the Hob and Gear Sound Committee and member of the Inspection Committee.**

The U. S. Navy has undertaken a program of developing carbide-tipped hobs for cutting marine gearing. This program, and the results obtained to date, have been reported from time to time by the American Gear Manufacturers Association and in numerous trade and technical journals. While some progress has been made in the application of carbide hobs for marine gear manufacture, various factors—such as size of gearing, materials and the design and limitations of large hobbing machines—have prevented the completion of extended and conclusive tests.

Being a manufacturer of all types of gearing ranging from marine gears to small speed reducers, the Falk Corporation has naturally been very much interested in the application of the carbide hob. From our experiences in the hobbing of all sizes of gearing, it was obvious that the experimental work associated with this development should be reduced to its simplest form. Therefore, the logical starting point is on gears of small or medium size where the machines offer sufficient range in their operation without imposing the limitations inherent in the hobbing of large gears.

For this reason, it was decided that, in undertaking our carbide hob research program, it be applied on gearing such as is used on geared-motor and speed reducer units. This

type of gearing permits cutting tests to be made on hobbing machines which can be operated at the high speeds required for optimum carbide tool performance. At the same time, the gear sizes are such that they can be heat treated to the higher hardnesses which limit the use of standard high speed steel hobs.

The results, obtained to date on our carbide hob tests, indicate that this approach to the problem is well justified. While the tests have not been completed to determine the ultimate performance that may be expected from this type of hob when applied to speed reducer gearing, the results provide pertinent and useful data for its further development. It is the purpose of this paper to briefly discuss the design, manufacture and test of the carbide hob as used to cut speed reducer gearing.

Design and Manufacture of Hob

The experimental hob was made to cut our standard speed reducer tooth form with a normal D.P. of 11.5526. In order to provide the necessary arbor rigidity the bore of the hob was made 1½" as compared with a 1" bore used on our standard high speed steel hob of the same pitch. The outside diameter of the hob was made approximately 4". This permitted the use of 12 gashes with sufficient length in the "backing" teeth to provide a rigid mounting for the carbide inserts.

The design and method of mounting of the carbide inserts was determined in cooperation with the Carboloy Company, who furnished the inserts in rack form and brazed them onto the hob body which was made in our shop. For this application, the Carboloy Company recommended a straight tungsten carbide of high abrasive wear resistance and therefore supplied their Carboloy grade 883. Due to the problems involved in the shrinkage of carbides after sintering, it was decided to limit the length of the first experimental hob so that each rack had 7 teeth. While this reduced the number of cutting positions for the hob, as compared with our standard hob, it permitted the brazing of the inserts so that the final errors in lead of thread were within economical grinding stock allowance.

The flute to flute spacing of the carbide inserts, after brazing, showed a total accumulated error of only .005". The flutes were ground for correct spacing to class "A" hob tolerances. Lead and profile of the hob teeth were then checked to determine the correct profile grinding procedure. In order to keep grinding wheel wear for this operation to a minimum it was decided to use metal bonded wheels. It was found that extreme care was required to keep these wheels from loading to assure free cutting. From the results obtained in profile grinding, it is believed that Resinoid bonded wheels may be used to advantage for this operation.

Fig. 1 shows the hob as finish ground. The simplicity of design and compactness obtained with brazing the inserts to the hob body as compared with mechanically held inserts used on some experimental carbide hobs is at once apparent.

Hobbing Machine Modifications for High Speeds

The cutting tests were scheduled to be made on a standard type "D" Barber Colman hobbing machine. The manufacturer of the machine was consulted with regard to changes to permit operating the machine at hob spindle speeds as high as 500 R.P.M. with comparable increases in work spindle speeds. Since this machine was equipped with a single thread indexing worm, the machine manufacturer recommended changing to a two-thread indexing worm and mating wheel to reduce the speed of the internal motion gearing for high work spindle speeds. This was done and the machine was given an idle running test at high hob spindle speeds to check lubrication and overall performance.

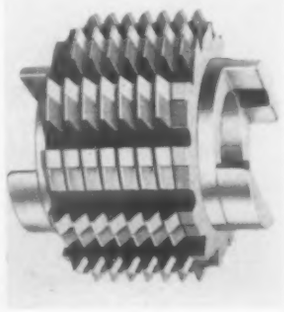


FIG. 1. The hob.

No difficulties were encountered at hob spindle speeds up to 378 R.P.M. as cutting tests progressed. The temperature rise in the spindle bearings was only slightly above normal values. To obtain spindle speeds up to 500 R.P.M. it was necessary to make a special set of speed change gears. At this speed the machine again performed without any signs of strain or abnormal temperature rise.

Description of Hobbing Tests

The hobbing tests were made on regular production runs of gears for standard geared-motor units. The numbers of teeth varied from 64 to 93 with a face width range from 1¼" to 1¾". All gears had a R.H. helix angle ranging from 31° to 40°. Material for the gears on all tests was Maxel 3½ (Manganese-Chrome-Molybdenum Steel) heat treated to a hardness of 285 to 330 Brinell.

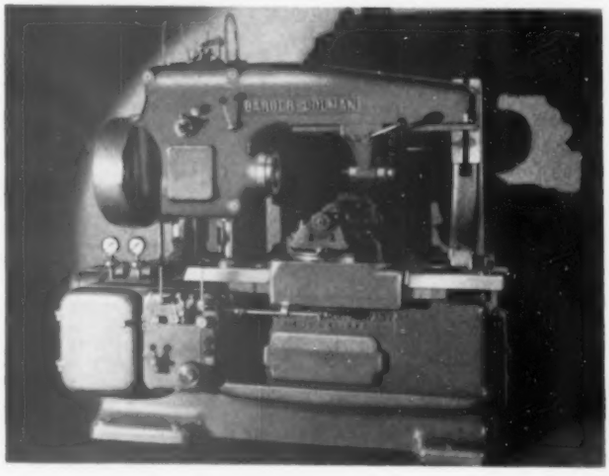
Standard work mounting equipment used for regular production of these gears consists of hardened and ground spindle adapter, mandrel and two locating plates which clamp against the rim of the gear. This same equipment was used for the carbide hob test and is illustrated in Fig. 2, which shows the hob setup in climb cutting position with a partial rough cut on a test gear.

Test No. 1

Since there was no performance data available on carbide hobs when used for gearing of this type, it was decided to make the first series of tests as a finish cutting operation on gears previously rough cut with a standard high speed hob. For this pitch rough cuts are made with standard finishing hobs so that stock allowance on thickness leaves from .020" to .025" stock at the root of the tooth to be removed by the finishing cut. When finish cutting these gears with a standard high speed steel hob a spindle speed of 88 RPM (57 ft./min. surface speed) and .050" feed is used. With the carbide hob the first nine test gears were finish cut with a spindle speed of 183 RPM (178 ft./min. surface speed) and feeds varying from .060" to .110" with conventional and climb cutting.

It was found that feeds up to .070" per revolution of the work resulted in the desired finish. With this feed the spindle speeds were gradually increased until a maximum of 378 RPM (368 ft./min. surface speed) was obtained on the last 5 gears of this test. A total of 32 pieces were finish cut on this test for which detail specifications and results are given in the test summary.

Type "D" Barber-Colman hobbing machine.



Total wear on the hob teeth for the first test required .012" stock removal on the face. The average amount of stock removed for each sharpening of the standard high speed hob is about .020". Since the gears had been rough cut, the hob required positioning for each cut and with the limited length on the carbide hob the equivalent of two cutting positions were obtained as compared with four to five on the standard hob. Each cutting position for the standard hob produces from 4 to 5 gears as compared to 16 for the carbide hob. A conservative ratio, therefore, of pieces per grind for the carbide hob is about a 3 to 1 gain. In addition, the actual cutting time as obtained on the last five gears was reduced to 16.6% of the standard hobbing time.

All of the gears cut had a clean finish with no chatter marks or burrs on the top lands of the teeth. This was true whether the gears were cut by conventional or climb hobbing. For each change made in feed and speed inspections were made to determine accuracy of helix angle and the amount of helical lead runout. It was found that all of the pieces cut were well within our established tolerances for gearing produced with standard hobs.

Test No. 2

Having determined the desired feed of .070" per revolution, it was decided to make another finish cutting test with a constant spindle speed of 318 RPM. All gears for this test had 86 teeth, 1½" face width, and 40° helix angle.

Conventional hobbing was used and after cutting 8 gears the tips of the teeth on the leading side of the hob showed a slight scuffing. After cutting 10 more pieces, or a total of 18, the hob was shifted to its second position. All of the pieces showed a good clean finish with very little change in cutting edge of the hob teeth.

With the second cutting position 11 pieces were completed with conventional hobbing and after thoroughly inspecting the cutting edges, an additional 16 pieces were cut by climb hobbing, making a total of 45 pieces for one sharpening of the hob.

All of the gears cut had a very good finish and helical lead checks showed that helix angle and runout errors had again been held below established tolerances. At the end of this test it was necessary to grind off .015" on the face of the teeth to resharpen the hob.

The number of pieces per grind for each position averaged 22 as compared with 4 for the standard hob, or a gain of more than 5 to 1. The actual cutting time was 20% of that for a standard hob.

Test No. 3

The tests made on finish cutting having produced excellent results, a rough cutting test was made on gears having 80 teeth, 1½" face and 40° helix angle. A hob speed of 378 RPM was used for all pieces cut.

While it was originally intended to cut the gears to correct finish size with one cut, it was found that, due to the high helix angle, the full generating position of the hob was such that excessive cutting loads were imposed on the leading hob teeth. After cutting two gears it was decided to shift the hob toward the lead-in side and rough cut the teeth with finishing stock allowance for removing the resulting profile error.

With the hob in this position a total of 13 pieces were cut with climb hobbing as illustrated in Figs. 2 and 3. Feeds of .030" and .040" per revolution of the gear were used and by careful examination of the hob after each test piece it was found that .040" feed resulted in accelerated wear.

The amount of stock removed in sharpening of the hob was .020" for this test. The 13 pieces per grind for one position as compared with 4 for a standard hob shows an increase of 3 to 1. The actual cutting time was 38½% of that required with the high speed steel hob, using a speed of 88 RPM and .050" feed.

Test No. 4

Based on the results obtained in the first rough cut test, it was decided to experiment with slight modifications in rake angle at the top of the teeth to provide negative rake. After these changes were made, another rough cutting test was made on the same size gear.

By means of special speed gears the hob speed was increased to 500 RPM (488 ft./min. surface speed). A feed of .030" per revolution of the gear was used.

A total of 19 pieces were cut and while the wear on the hob teeth gradually increased, a good clean finish was obtained on all pieces. On the 20th gear the machine started to labor slightly so the test was stopped and the hob removed. The total wear on the hob required .020" stock removal on the face of the teeth for resharpening.

Based on the results of this test, a total of 16 pieces per grind per hob position appears to be an economical yield. The standard hob yield, being about 4 pieces, a ratio of 4 to 1 for carbide hobs is also possible in rough cutting. Based on the high speed steel hob roughing cut speed and feed for this gear, the actual cutting time was reduced to 30% with the carbide hob.

Test No. 5

Since the 500 RPM spindle speed was easily handled by the hobbing machine, it was decided to make an endurance run on finish cutting the gears which had been rough cut during the previous tests. A feed of .060" was used with 500 RPM spindle speed.

FIG. 2. Set-up for climb cutting.

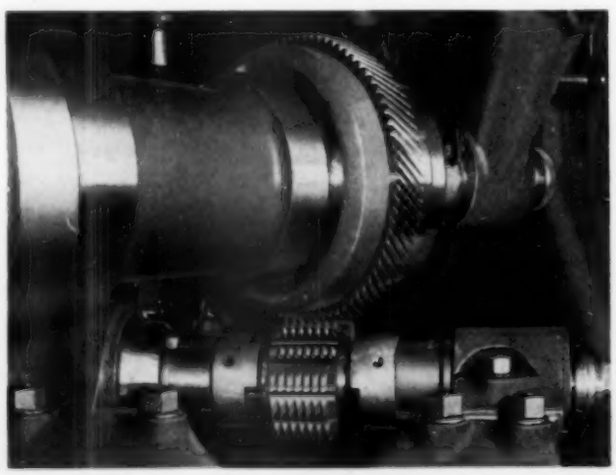
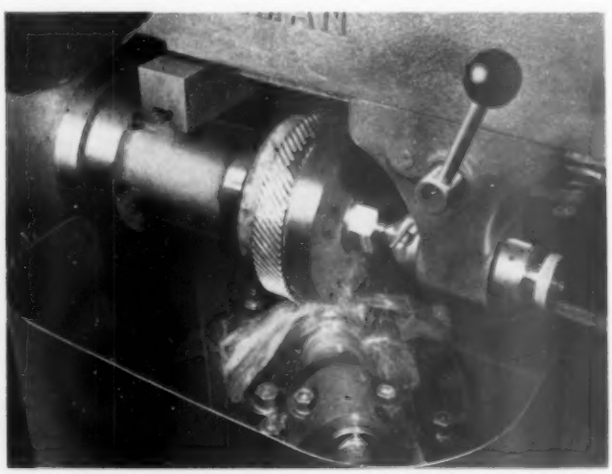


FIG. 3. Climb cutting from lead-in side.



A total of 34 pieces were finished with conventional cutting using the two positions on the hob.

Wear on the hob required .012" stock removal for resharpening. The ratio of pieces per grind per hob position was again 4 to 1 with actual cutting time reduced to 15% of that required with high speed steel hobs.

Conclusions

While the general results for each test have been briefly recorded in the foregoing discussion, a complete test summary is given in table No. 1 (below) to serve as a handy reference for comparison of test results.

The results of the tests made to date on this hob have been very encouraging. With the carbide hob the actual cutting time has been reduced to only a fraction of that required for high speed steel hobs. At the same time a corresponding increase in pieces per grind has been obtained. In addition, it appears that a substantial saving in hob cost per gear can be realized, although this could not be determined since this carbide hob was produced as an experimental development.

However, the results are conclusive evidence of the possibilities that the carbide hob offers on heat treated speed reducer type gearing. Tests are already in progress to determine the maximum hardness on gears for economical hobbing with carbide hobs. To obtain the cost per gear including hob costs, additional hobs are now being manufactured for use on overall performance tests.

Based on the tests made to date, it is the writer's opinion that the application of carbide hobs to the production of heat-treated small and medium size gearing will open a new era in gear production. With a continuance of the close cooperation between the manufacturers of carbide tips, hobs and hobbing machines, and the gear manufacturer, which has prevailed through this entire research program, the future possibilities of the carbide hob can be fully explored to the best advantages of all concerned.

The writer wishes to acknowledge the work of Mr. James W. Berenson of The Falk Corporation Engineering Department, who was assigned to this project to carry out the design of the hob and follow through on its manufacture and test.

Because of the tremendous interest in this Symposium, and particularly in view of the authoritative sources, we have decided to carry it over into another installment—possibly two. When concluded, the Symposium will have covered practically every phase of modern gear manufacture.

Test No.	No. of Pcs.	No. of Teeth	D.P.	Helix Angle	Face	Depth Cut	Feed	Speed	Gears Rgh. Cut	Gears Fin. Cut	Remarks
1	3	80	8.85	39°59′53″	1½″	.020″	.060″	183		3	2 Pcs. Conventional Cut; 1 Pc. Climb Cut
1	2	80	8.85	39°59′53″	1½″	.020″	.070″	183		2	1 Pc. Climb Cut; 1 Pc. Conventional Cut
1	2	80	8.85	39°59′53″	1½″	.020″	.090″	183		2	Conventional Cut
1	2	80	8.85	39°59′53″	1½″	.020″	.110″	183		2	Conventional Cut (Slight Wear-Leading Tooth)
1	3	93	9.11	37°54′43″	1¾″	.028″	.090″	230		3	Conventional Cut (Increase in Speed Improves Cutting Action)
1	2	93	9.11	37°54′43″	1¾″	.028″	.070″	230		2	Conventional Cut (Lower Feed Reduces Size of Scallops)
1	4	64	9.90	31° 1′29″	1¼″	.024″	.070″	270		4	Conventional Cut (Slight Wear on Profile of Hob. No Cratering or Chipping of Carbide)
1	4	64	9.90	31° 1′29″	1¼″	.024″	.090″	270		4	Conventional Cut (Tip on Leading Tooth Shows Approx. .005″ Wear)
1	5	64	9.90	31° 1′29″	1¼″	.024″	.070″	318		5	Conventional Cut (Additional Speed Improves Finish and Cutting)
1	5	64	9.90	31° 1′29″	1¼″	.024″	.070″	378		5	Conventional Cut (Less Pounding of Machine. Removed .012 to resharpen)
2	29	86	9.11	37°56′51″	1½″	.028″	.070″	318		29	Conventional Cut (After 8 Gears Hob had Slight Wear. After 18 Gears, Changed Setting)
2	16	86	9.11	37°56′51″	1½″	.028″	.070″	318		16	Climb Cut to Complete Order (Better Hob Life. Less Drag on Machine. Removed .015″ to Resharpen)
3	2	80	8.85	39°59′53″	1½″	.204″	.030″ to .040″	378	2		Climb Cut (Full Depth to Finished Size. Excessive Wear on Leading Tooth Due to High Helix Angle)
3	13	80	8.85	39°59′53″	1½″	.190″	.030″	378	13		Climb Cut (Profile Error Due to Hob Setting For Long Lead-In. Removed .020″ to Sharpen)
4	20	80	8.85	39°59′53″	1½″	.190″	.030″	500	20		Climb Cut (Hob Ground With 5° Neg. Tip for .030″. Hob Started Dragging on 20th Gear. No Cratering or Chipping on Carbide. Removed .020″ to Sharpen)
5	35	80	8.85	39°59′53″	1½″	.024″	.060″	500		35	Conventional Cut (Hob Wear Uneven Around Periphery. Clean Cut. Removed .012″ to Sharpen)

By B. T. Anderson

Electronics Applied to Machine Tools*

Electronic "Brains", Supplementing the Human Element, Control Automatic Cycle Machines and Increase Production

As this article deals, primarily, with the application of the electronically controlled, adjustable speed drives to machine tools, a brief description of the component parts of the drive is in order for a better understanding of its operation.

First of all, the business end of the drive is a shunt wound, direct current motor. This motor is illustrated at the right in Fig. 1, and consists of a field winding which is stationary, and a wound armature which rotates and converts electrical energy to mechanical power. Since the power conversion takes place in the armature, the armature circuit requires from 97 to 99% of the power supplied to the motor with the balance being consumed by the field circuit.

The sketch on the left, in Fig. 1, is a schematic diagram of the shunt motor. As shown, the field "F" and the armature "M" are connected in parallel to a direct current source of power. The motor, when connected in this manner, is a constant speed device.

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There are two methods of varying the speed of this motor. The first—or field control method—is pictured in Fig. 2. With full voltage on both the field and the armature, the speed developed by the motor is called the *base speed*. As the voltage across the field is lowered, the speed of the motor increases. Speed changes of three, and possibly four to one, can be obtained in this manner. When the speed is increased by weakening the field, the torque decreases at the same rate as the speed increases so that this type of control results in a drive with constant horsepower output.

The second method, of controlling the speed of the shunt motor, is to maintain constant voltage on the field and vary the armature voltage. This method is known as *armature control*, and it is illustrated in Fig. 3. As mentioned before, the speed developed with full voltage on field and armature is known as base speed. When the field voltage is maintained constant, and the armature voltage is lowered, the motor speed decreases directly with the armature voltage. Since the field strength is constant, the motor torque is constant and the horsepower output of the motor decreases directly with the speed. Speed variation by this method is theoretically infinite but for practical purposes it is about 20 or 25 to 1.

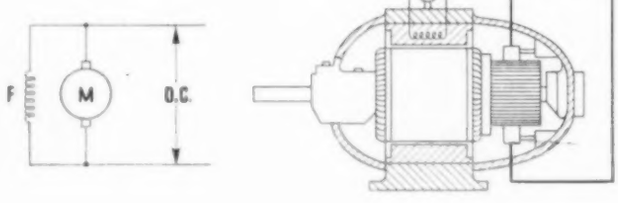
It is obvious that, by combining armature and field control, the speed range of the shunt motor is approximately 100 to 1. It is also obvious that operation, through such a speed range, requires two sources of power for the motor, each of which must be independently adjustable. These can be obtained by several methods, but the controlled conversion of a.c. to d.c., by electronic means, is the newest method and the one which lends itself most easily to automatic control.

In describing the electronic part of the adjustable speed drive, the best starting point is a definition of electronics. Electronics is that part of the electrical science which deals with conduction of electricity through a vacuum or through a gas. To understand the conduction of electricity through a vacuum, it is necessary to go back to the electronic theory of matter. According to this theory, the smallest particle which retains its identity as an element is the atom. It consists of a nucleus of protons which have a positive electrical charge and one or more electrons revolving about the nucleus in the same manner as the earth revolves about the sun.

The electrons are unit negative charges of electricity which are equal to the positive charge on the protons in the nucleus. The differences in the various elements are due to

*Resume of a talk, by Mr. Anderson, at a recent meeting of Hamilton Chapter, A.S.T.E.

FIG. 1.



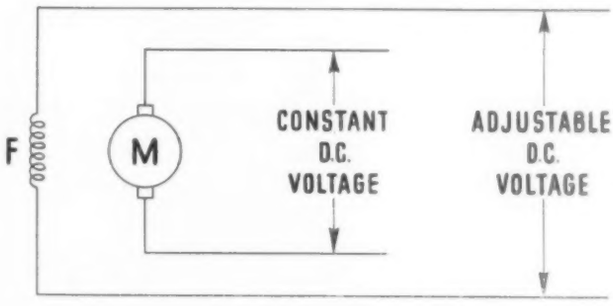


FIG. 2 above.

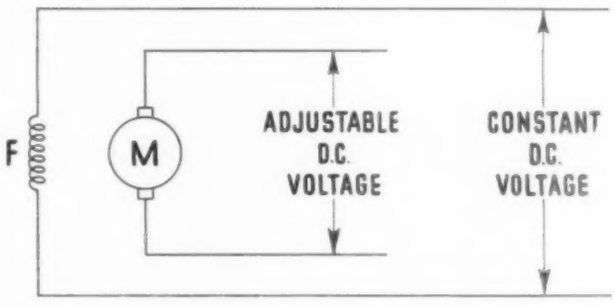


FIG. 3 below.

the number of electrons and protons making up the atoms. In some of the more complex elements, the electrons are only loosely held to the nucleus and can move easily from atom to atom.

Materials in which such electron movement can take place are said to have free electrons. Examples of this are copper, silver and aluminum, which are good conductors of electricity. In other materials, the electrons are held strongly by the attraction of the positive charge of the protons, and such materials are known as insulators because it is difficult for the electrons to shift from atom to atom.

There are several methods of conducting electricity through a vacuum, but the one which we must consider is the one known as thermionic emission. It is illustrated in Fig. 4. The tube shown has two elements of conductive material which are labeled anode and cathode. They are enclosed in an evacuated, glass envelope. The cathode is usually heated by electrical means, such as illustrated in Fig. 4 where the voltage of battery "A" causes a current to flow through the cathode. This generates heat, and when the temperature is raised sufficiently, the cathode will emit electrons.

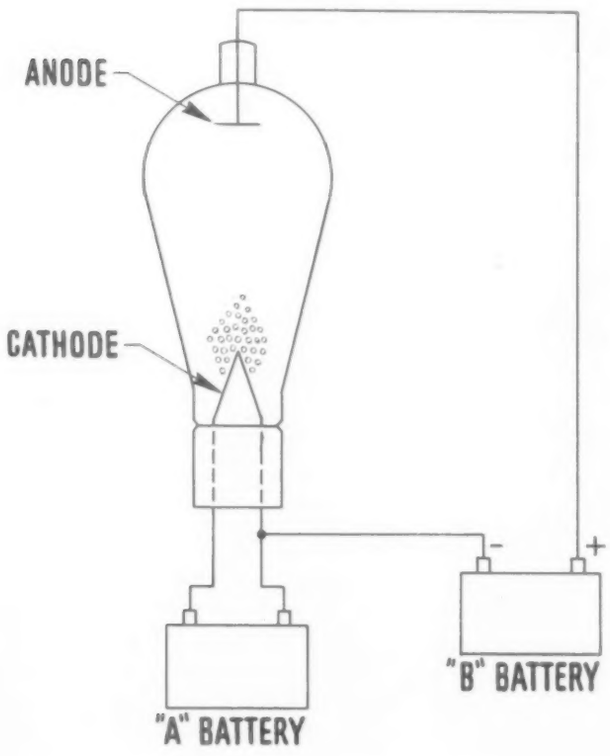
By connecting a voltage such as battery "B" so that the positive battery connection is to the anode and the negative side is the cathode, the free electrons in the anode will flow towards the battery. This leaves the anode with a positive charge, thereby attracting the electrons emitted by the cathode. This flow of electrons, from cathode to anode, through the battery and back to the cathode constitutes an electrical current. If the connections of the battery "B" are reversed, the battery voltage will force some extra electrons on to the anode, thus building up a negative charge on the anode.

Since like charges repel each other, the free electrons emitted by the cathode will be repelled by the negative charge on the anode, thus preventing the flow of current. Therefore, the current in a two element tube will always flow from cathode to anode. This property of the tube is used to convert alternating current into direct current. The process is termed rectification and the tube is known as a half wave rectifier.

The rectification of alternating current is pictured in Fig. 5. In this figure, two half wave rectifiers are so connected to the source of alternating current power that full wave rectification is obtained. The circles represent oscilloscopes, which are so connected that they show the wave shape of the voltages before and after rectification. Oscilloscopes 1 and 2 show that when the anode voltage of tube "A" is positive, the voltage on tube "B" anode is negative, and vice versa. Oscilloscopes 3 and 4 show that the two element tube only passes the positive half of the voltage waves and that the result of half wave rectification is an intermittent direct current. Oscilloscope 5 shows the result when two half wave rectifiers properly connected are used for full wave rectification and the result is a pulsating direct current.

The two element vacuum tube described above is only suitable for use when low currents at high voltages are to be rectified. Where larger currents at commercial voltages are required, the two element tube is filled with a gas such as mercury vapor. We now have a rectifier which will handle considerable amounts of power but which lacks one important feature. This feature is the ability to control the magnitude of the output voltage.

FIG. 4.



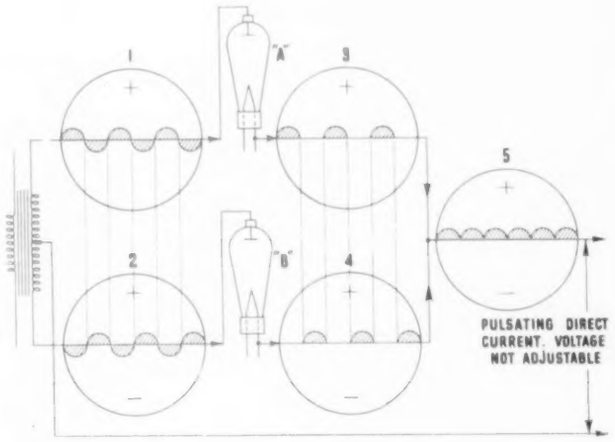
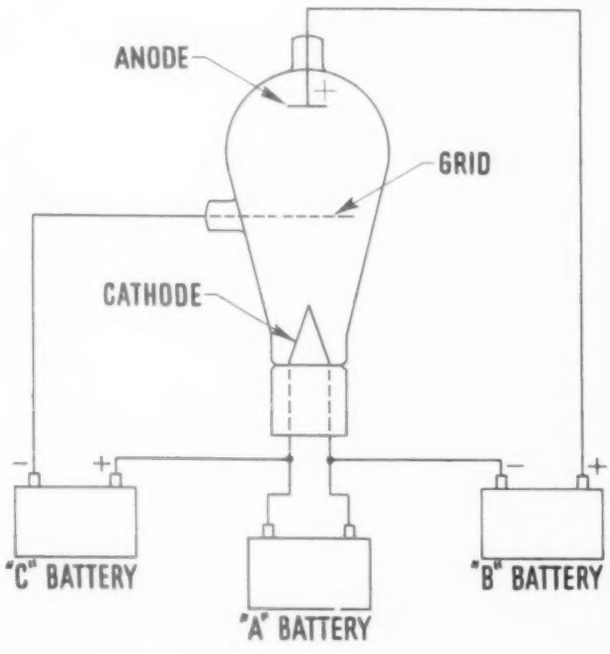


FIG. 5—Above.

FIG. 6—Below.



To obtain control, it is necessary to add another element to the tube. This element—known as the grid—is shown in Fig. 6, which illustrates a three element vacuum tube. The grid consists of a fine wire mesh which is placed between the cathode and the anode. A source of voltage, such as battery "C," is so connected that the grid is negative with respect to the cathode. This causes electrons from the battery to flow into the grid, which thereby becomes negatively charged and tends to repel the electrons emitted by the cathode. If the voltage of battery "C" is sufficiently high, the negative charge on the grid will entirely block the flow of electrons from cathode to anode.

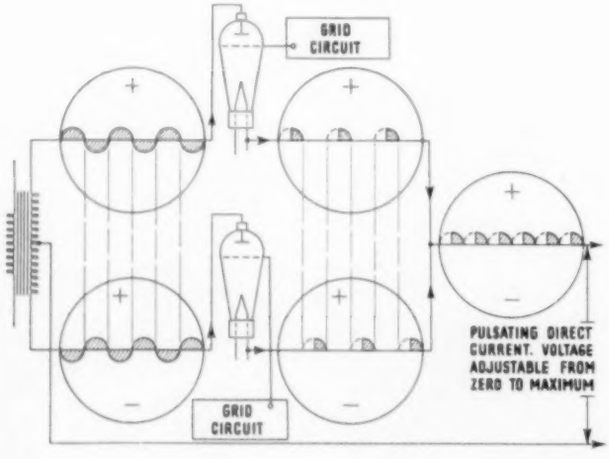
As the negative voltage on the grid is reduced, the current from the cathode to the anode will increase until, at zero grid voltage, the anode current is the same as if the tube did not have a grid. Now, if the "C" battery voltage is reversed, so that the grid becomes positive, the anode current will become larger than if there weren't any grid at all. Therefore, a positive grid aids the conduction of current from cathode to anode and a negative grid retards the current flow in a vacuum tube.

Actually, a change of 1 to 2 volts on the grid may change the anode current from full on to cut off. Since there is no current flow in the grid, its power requirements are very low. Hence, a very minute amount of power applied on the grid will control relatively large amounts of power through the anode circuit.

When gas is added to the triode, to increase its current carrying capacity, the grid loses some of its control. However, it retains one feature which makes possible the controlled rectification of alternating current. This feature is the ability to select the point at which the tube will start to conduct current. This is illustrated in Fig. 7, which has two half wave rectifiers connected for full wave operation. As shown, the grid control is set so that the tube starts to conduct current at the mid-point of the half cycle. By simple adjustment this firing point can be set at any point on the half cycle, so that any portion of the half wave from full on to off can be obtained. Hence, the output voltage can be adjusted from zero to maximum. This gas filled, grid controlled tube is known as a *thyratron tube*.

Since a wide range speed drive employing a shunt wound d.c. motor requires two sources of d.c. voltage, it is a simple matter to make an arrangement, such as shown in Fig. 8, which provides independently adjustable d.c. power to both the field and the armature directly from the a.c. line. Since the field requires only from 1 to 3% of the total motor power, a pair of small thyratrons (shown on the left) are used to supply the field circuit. On the right a pair of larger thyratrons supply the armature power.

FIG. 7.



The control circuits used to regulate the grid voltage are rather complicated and are beyond the scope of this discussion. However, the actual control medium which must be actuated to vary the speed of the drive is very simple. For manual or for mechanically actuated, automatic operation, the actual device may be a potentiometer about the size of the volume control on your radio. The potentiometer for manual operation is usually mounted on the push button station as shown in Fig. 3. For automatic operation, by a machine slide or similar device, we ordinarily use a four inch diameter potentiometer which can easily be built into the machine. This size of potentiometer is still a small device as compared to the conventional rheostats of motors or generators.

The ability of the grid to control the flow of current in the thyratron tube provides the electronically controlled, adjustable speed drive with the following advantages over other types of drives:

1—Suitable adjustments are provided which will limit the maximum current the motor will take. This is usually set between 100 and 200% of the full load current. In the event of stalling, the motor will only draw this preset value of current, and under continued stall the usual thermal elements will disconnect the motor from the line.

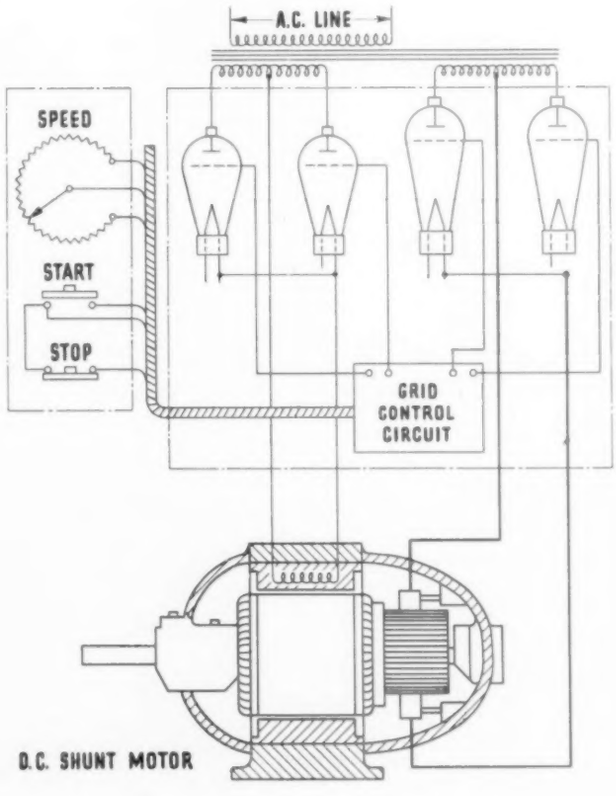
2—Current limit control provides smooth acceleration because 150 to 200% torque is continuously available during acceleration.

3—The speed regulation of the drive is very good. The control circuit is so designed that as the load on the motor increases the normal tendency of the motor to slow down is counteracted by a slight increase in armature voltage, thereby maintaining constant speed.

4—The small size of the potentiometer is a decided advantage where speed control has to be built into the machine.

To provide some idea of the value of these drives on machine tools, we have picked out two of several different jobs. For each, we will endeavor to show the tooling prob-

FIG. 8.



lem, the type of drive provided for the machine and the advantages over a standard drive.

One of these applications is of special machines for milling the "faying" surface on a steel propeller barrel and a mating surface on an aluminum part. The difficult part of this job is to maintain the accuracy and uniformity of finish necessary at all points on the irregular surface to be machined. Fig. 9 is a simple sketch showing the machine movements necessary to mill this surface on the propeller barrel. Note that the machine must have four "rise and fall" movements of the cutter as the part is rotated through a full 360°.

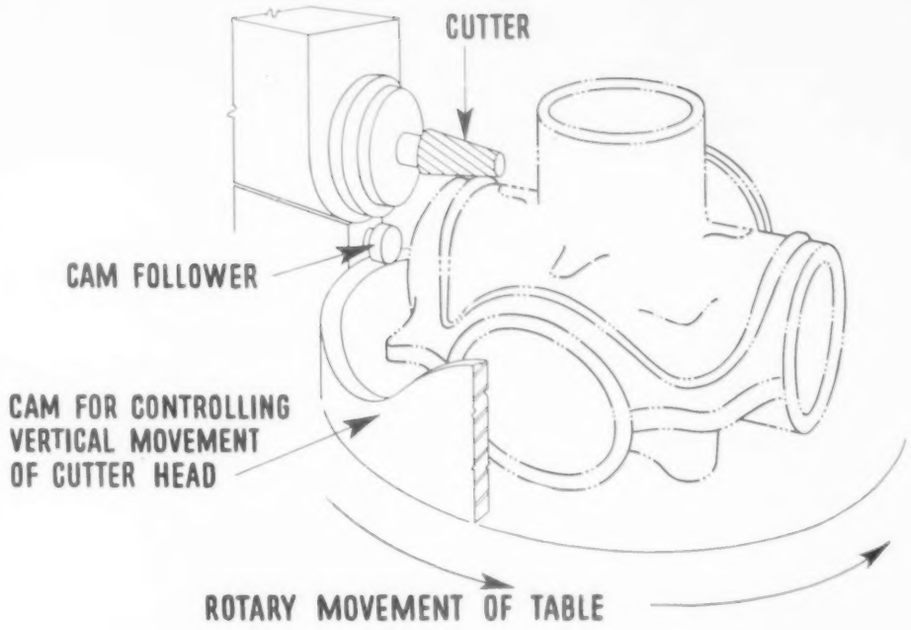


FIG. 9.

Shown in Fig. 10 is the machine furnished for this operation. It consists of a cross feeding head carrier with vertical ways, a swivel type power fed head mounted on the head carrier ways, and a rotary table driven by an adjustable speed motor. The cross feed of the head carrier is by means of one hydraulic cylinder and the vertical feed of the head by a second hydraulic cylinder.

One hydraulic pump supplies both cylinders and the sequence of operations is controlled by cycle valves. The hydraulic system is controlled by electrically operated solenoid valves and is interlocked with the table drive unit to provide a complete automatic machine cycle after the part is loaded in the fixture.

The cycle of the machine is as follows: First the table is positioned by a limit switch so that the cycle cannot be started unless a table dog engages the limit switch. With the tables in position and the part loaded the operator pushes the "Cycle Start" button. The column then rapid approaches and finally feeds just before positive stop. At positive stop the head feeds down until the roller engages the cam.

Just as the roller touches the cam, a limit switch on the head starts the rotary table in the cut direction. The rotary table then feeds 360°, at which point a table limit switch reverses the head hydraulics. The head then rapids up to positive stop, and the column rapid returns to its starting point. When the column is all the way back, the table reverses and feeds back to reposition itself for the start of another cycle.

The table is driven by an electronically controlled adjustable speed motor with a speed range of 50 to 1150 RPM by armature control in the forward or cutting direction. In the reverse direction the speed of the motor is adjustable from 50 to 1150 RPM by armature control and 1150 to 2300 RPM by field control. The motor is rated 2 HP at 1150 RPM and is constant torque with armature control and constant horsepower with field control. The motor is forced air ventilated by a blower which supplies air at the rate of 50 cu. ft. per minute.

The speed range, in the cutting direction, provides table feed rates from 0.43" to 10" per minute at the work diameter, which is 13½". The forward feed rate can be adjusted manually, and it is adjusted automatically during the cut. In the reverse direction, the maximum rate is theoretically 20" per minute but, due to decreased torque by field control, the speed of the motor is limited to 1900 RPM—which is

FIG. 10.

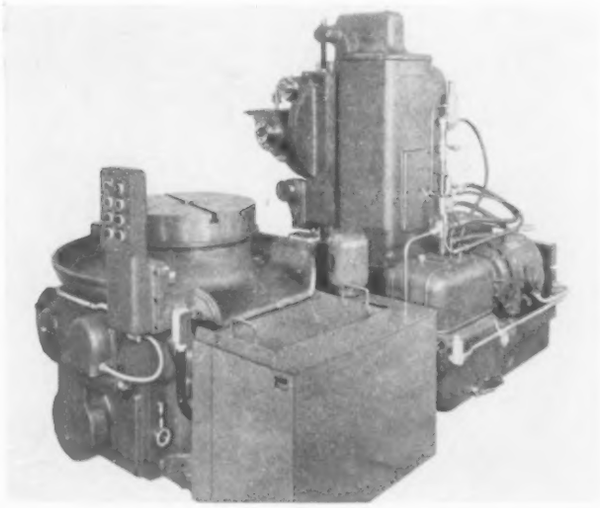
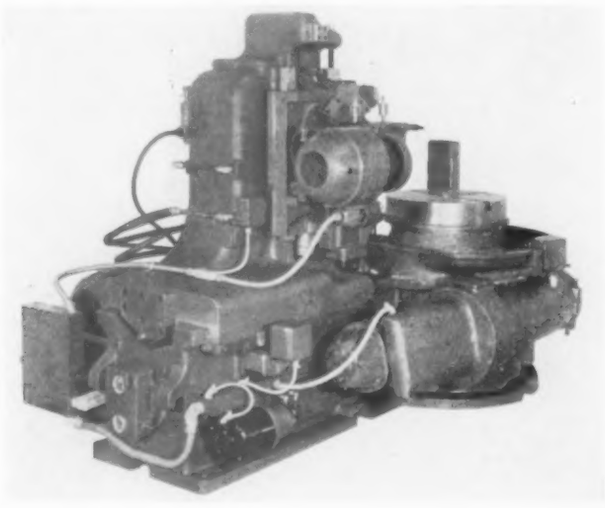


FIG. 11.



equivalent to 16.4" per minute on a 13½" work diameter. The reverse speed is manually controlled by a separate potentiometer. Fig. 11 shows the table drive with variable speed motor "A," planetary gear reduction "B," and worm and worm wheel at "C."**

Fig. 12 illustrates the machine with a high speed head used in milling the aluminum part. The spindle operates at 3400 RPM and is directly belted to its drive motor. The machines for milling the steel part are similar except that the head is of the geared type with spindle speeds from 50 to 2900 RPM by pick-off gears. Both of these heads can be pivoted so that the spindles will be 15° from the horizontal either up or down.

As mentioned previously, the tolerances for machining this contour were very close. Since the size of the cutter was limited to one with ¾" diameter shank we were afraid that any uneveness in the feed rate would show up in the finished cut. Therefore, we applied an electronically controlled adjustable speed motor to drive the rotary table so that the feed rate with respect to the cutter would be constant.

As mentioned before, the head has four rise and fall cycles as the table makes one complete revolution. The diameter of the work at the cut is 13½", which corresponds to a circumference of 42". However, the actual cut is approximately 52" long. Therefore, if the table feed rate were constant, the average feed rate at the cutter would be about 25% higher than the table feed. Since the steepest angle the cutter climbs is 48° with the horizontal, the actual instantaneous feed rate may be 50% above table feed rate.

To compensate for the action of the vertical feed our engineers designed the unit pictured in Fig. 13, which maintains constant feed at the cutter and also provides the feed rate adjustment. Since the four rise and fall cycles of the head are identical, the shaft which rotates cam "A" makes four revolutions as the table makes one. Cam "A" moves cam followed bar "B" vertically. Fastened to cam follower bar "B" is the feed rate adjustment plate "C" which by means of a roller fastened to rack "D" moves potentiometer "E" to adjust the speed of the table drive motor.

The gear ratio between rack "D" and the potentiometer is such that 1.60" of movement by the rack rotates potentiometer arm through 300°. This varies motor speed from 50 to 1150 RPM. The design of the speed adjustment plate is such that regardless of its setting the vertical stroke of cam follower bar "B" changes the table feed in the ratio of 1.5 to 1. When the adjustment is such that slot "F," which actuates roller on rack "D" is at 35° with the vertical, the motor speed ranges between 776 and 1150 RPM, and the setting produces maximum feed rate. The minimum feed setting provides motor speed variation between 50 and 74 RPM.

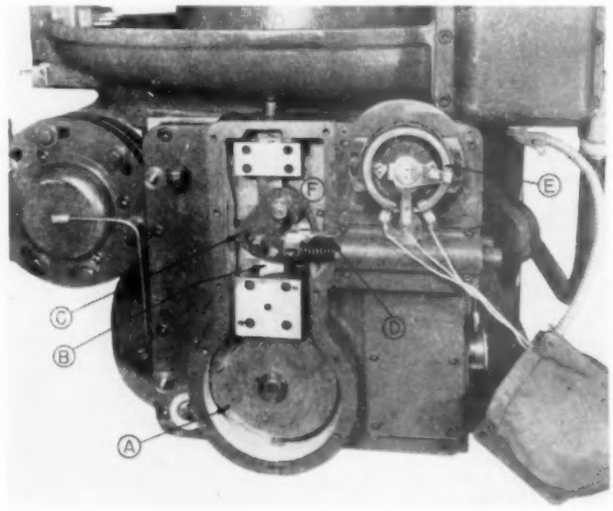
Therefore, by adjusting from maximum to minimum the angle between slot "F" and cam follower bar "B," the actual feed rate at the cutter can be varied in a ratio of 15.5 to 1. Also, at any setting of plate "C," the table feed rate is varied automatically through a range of 1.5 to 1 to maintain a constant feed rate at the cutter. This compensates for the vertical feed caused by the rise and fall action of the head while following the master cam.

The other application involves a special machine designed to mill the circular, partial and dome fins on the forged aluminum cylinder heads for airplane engines. This machine is designed to mill all fins in two operations as against four operations in the old setup. In the first operation all the body fins, both circular and partial, are milled. In the second operation all the dome fins are milled. The machine, as used in the first operation, is shown in Fig. 14.

In order to describe the machine functions, it is best to discuss each of the various drives separately and then to describe the sequence of operations.

The machine operates on the "Copy Mill" principle in that the depth of each cut is controlled by the roller, in the spindle member, engaging a master cam which is mounted on the work rotation drive. The spindle "A" and the cam roller "B" are mounted on the rocker arm at "C" in Fig. 15.

***Symbols omitted; however, they apply to forward, center and far end of motor shown at lower right.*



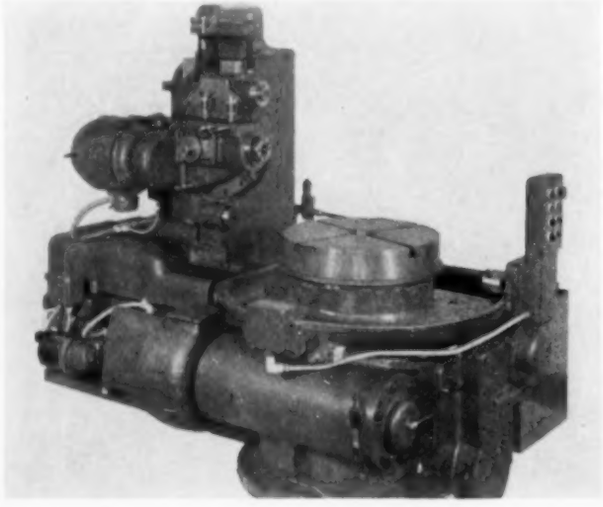
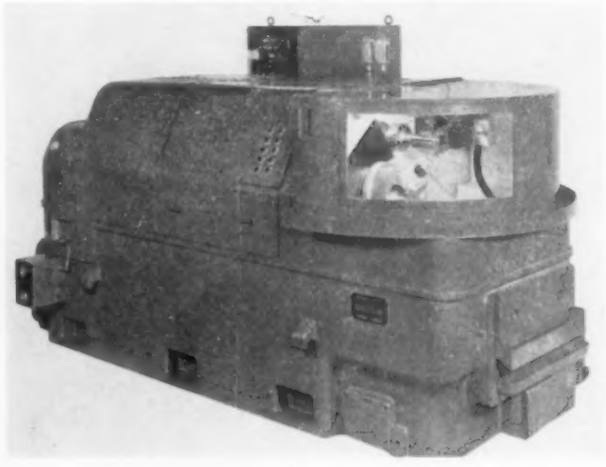


FIG. 12 at left, FIG. 13 above, FIG. 14 below.



This rocker arm is pivoted on widely spaced bearings at "D" and "E." A hydraulic cylinder at "F" provides rapid approach, slow feed, fast feed and rapid return to cutter and roller by rocking the arm about its pivot point.

The spindle is driven by 7½ HP, 3450 RPM squirrel cage motor. The drive is by V-belt ("A" in Fig. 16) to a jack shaft through the center of the rocker arm pivot. The jack shaft in turn is connected by V-belt to the spindle. The drive is a 1 to 1 ratio so the spindle runs at 3450 RPM which corresponds to 5900 surface feet for the cutter used on the first operation.

The work and the master cams are rotated by means of a two motor, mechanical feed box shown at "B" in Fig. 16. The rapid traverse movement is driven by a special high torque, squirrel cage motor shown at "C." The feed is driven by an electronically controlled, adjustable speed motor at "D." This motor operates from 1750 RPM down to 175 RPM by armature control which is constant torque.

With the feed motor operating at 1750 RPM, the output of the feed box can be varied by "pick-off" gears "E" so that work rotation from one-half to four RPM can be obtained. This, on a 10" diameter corresponds to feeds from 15.7 to 125 inches per minute. It is obvious that any feed rate as set by the "pick-off" gears can be reduced in a 10 to 1 range by adjusting the speed of the feed motor. The output of the feed box is transmitted by a worm wheel to splined shaft "A" in Fig. 17. This splined shaft rotates the cams "B" and the work holding fixture "C" simultaneously.

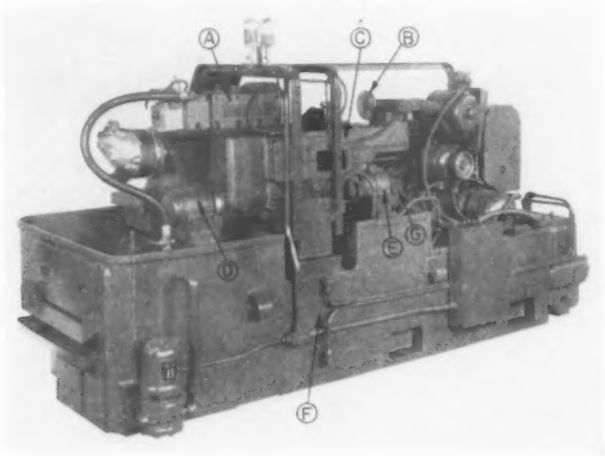


FIG. 15 above.

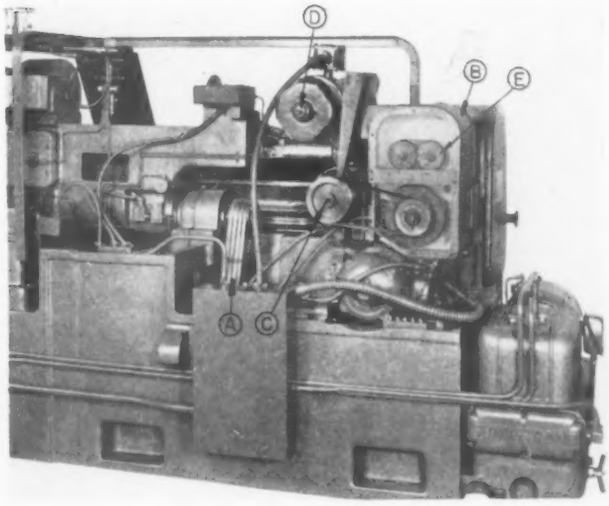


FIG. 16 below.

After each cut, the work slide "D" and the cam carrier slide "E" are indexed laterally to position for the next cut. The indexing mechanism consists essentially of an electrically operated rotary index base which has been converted to linear indexing by gearing to it a suitable lead screw. The lead screw has a single thread on ¼ of its length and triple thread on the balance. The triple thread section moves the cam carrier slide and the single thread section moves the work slide. Hence, for each index, the cam carrier slide moves three times as far as the work slide. This allows the cams and cam roller to withstand the force required to hold cam roller against the cam during the cut.

The control of the work rotation and the index mechanism is shown in Fig. 18. The dog plate, at the top, is rotated by the splined shaft that rotates the cams and the work. The dogs on this plate operate four limit switches. One of the switches provides neutral. Two switches control the point at which the rocker arm is rapid returned when the circular

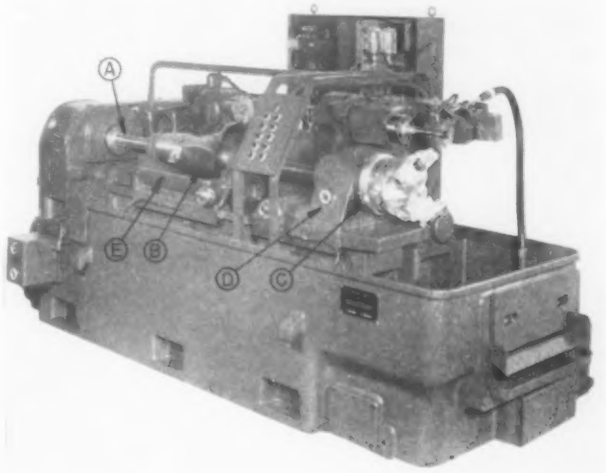


FIG. 17 above.

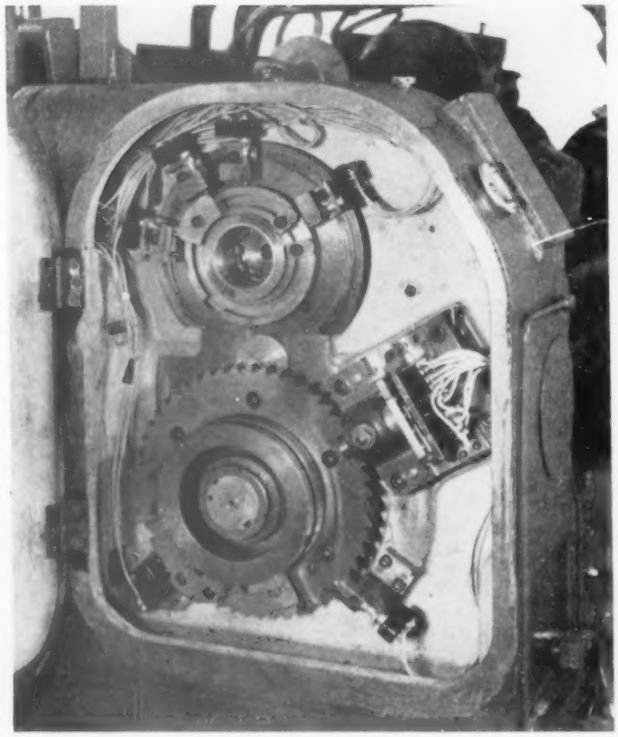


FIG. 18 below.

or complete fins are cut. The other limit switch controls the point at which the rocker arm returns when partial fins are being cut.

The notched plate in Fig. 18 is the index plate. This plate has one notch for each fin to be milled. The mechanism to the upper right of the plate is the locating plunger. The control of the index movement is by four limit switches operated by the plunger. The limit switch in the lower left hand corner, is operated by the floating of the index drive worm. At the completion of the index, the plate engages the locating plunger which causes the worm to float until this switch stops the index motor.

The floating of the worm compresses a spring which locks the index plate against the locating plunger. The switch in the lower right hand corner operates to shift the work rotation control from the 360° plus cycle for complete fins to the partial cycle. This switch is not used on the second operation because the dome fins are all partials and the machine is converted to cutting partial fins at all times by setting a selector switch in the push button panel.

Under normal operation, the operator loads the work and then pushes the "Cycle Start" button. This starts rocker arm in rapid towards the work and also starts the spindle motor. Just before the cutter reaches the work a limit switch is tripped by the rocker arm which puts the arm in slow feed and starts work to rotate at 1/10 of its maximum feed. Just as the cutter reaches its depth, a limit switch is closed by cam roller mechanism which puts both the rocker arm and the work rotation in fast feed. At the completion of the cut, the rocker arm rapid returns to its starting position.

When this position is reached, the work rotation rapid returns to its starting position and the work and cam carrier slides are indexed to positions for the next cut. With the work returned to its starting position and the indexing completed, the rocker arm automatically starts in towards the work and the above cycle is repeated until all fins are cut. With the cuts completed, the index mechanism returns the cam carrier and the work slides to the position for the first cut. The operator now unloads, loads and presses the "Cycle Start" button for another cycle as described above.

A part with the first operation completed is shown in Fig. 19. As you can see, the depth of cut varies from zero to the maximum possible with the cutter. Also, it is obvious that no two cuts are alike. The conventional approach on this job would be to set the feed rate to suit the deepest cut. If this were done, the production would be low. The next consideration would be to use more than one feed rate, but this is not practical because each cut is different which, for maximum production, requires a special feed control setup for each cut. The ideal solution, from the production angle, would be to vary the feed rate automatically so that the cutter would always be loaded to its full capacity and to limit the maximum feed so that the chip per tooth would be within good milling practice.

With the equipment available a few years back, this solution would have been considered impractical, but, the advent of the electronically controlled, adjustable speed motor provides a tool which can be used to solve many of the drive problems which would have been considered impractical in the past.

In order to get our variable feed rate, we used a 1½ HP, 1750/175 RPM, electronically controlled, adjustable speed motor on the feed drive in place of the conventional constant speed motor. In the previous drive described, the speed changing has been accomplished by means of a potentiometer. This method is not suitable for this application because the load on the cutter must control the speed of the feed motor.

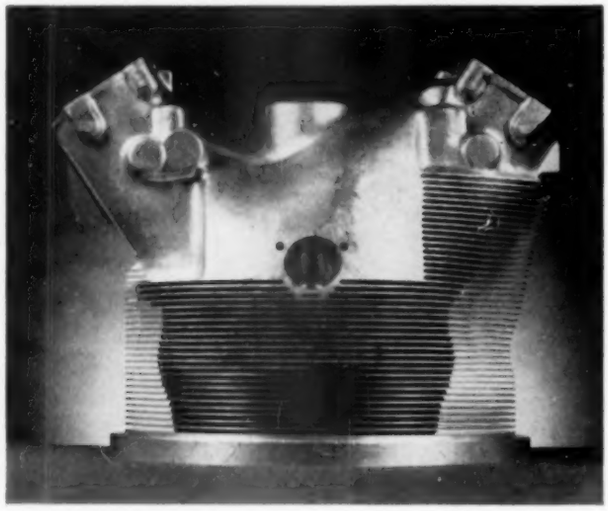
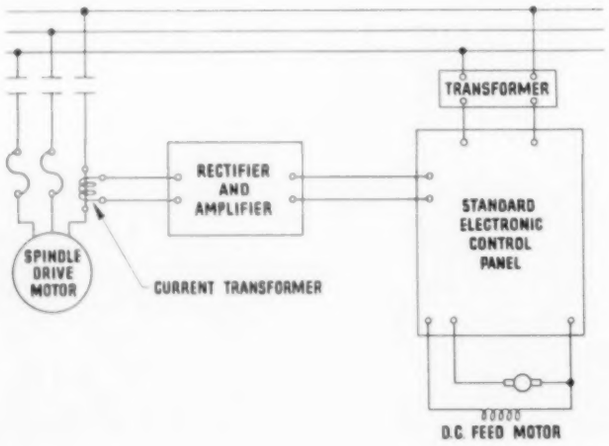
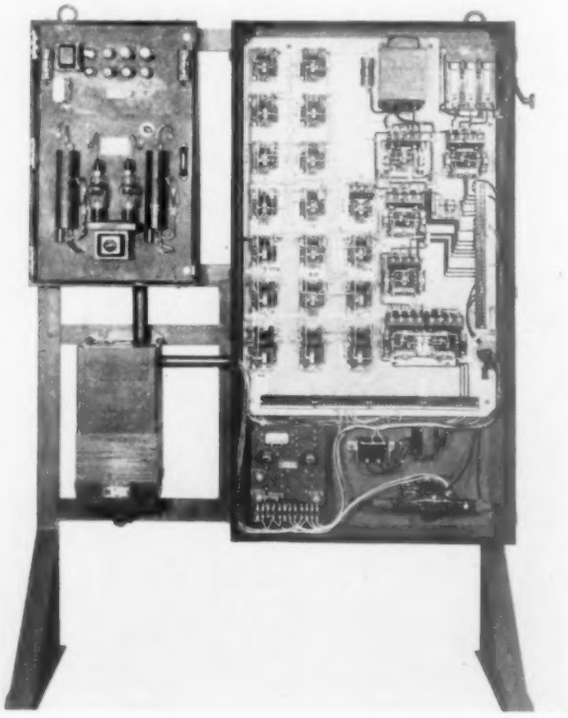


FIG. 19 above, FIG. 20 below, FIG. 21 at right.





Since the drive to the spindle is by means of a squirrel cage induction motor, the power required by this motor must furnish the control medium. The power of a squirrel cage induction motor, operating between 75 and 125% of its rating, is for practical purposes a direct function of the line current drawn by the motor. This permits the use of a current transformer in one of the lines to act as the control medium. Fig. 20 is a block diagram of control scheme used. The output of the current transformer is rectified and amplified and then fed into the control circuit of the standard electronic control panel.

The controls are so designed that the feed motor runs at maximum speed as long as the load on the spindle motor does not exceed its rated HP. This limits the maximum chip per tooth to a desirable value. Should the load on the spindle motor increase above its rated load, the feed motor slows down. At 125% load on the spindle motor, the speed of the feed motor drops to the minimum which is 175 RPM. In the event the load on the cutter is not relieved fast enough, the feed motor is dynamically braked to the minimum speed.

Fig. 21 shows the complete control equipment for this machine. The large panel on the right is the standard A.C. Control panel which controls all A.C. motors and the sequence of operations. The panel on the left is a standard electronic control panel. The main power transformer for the electronic controls is in the lower left hand corner. The lower part of the main cabinet on the right contains the auxiliary equipment required for the special load control. The current transformer is at "A" and the rectifier and amplifier panel at "B."

The use of the variable speed drive on this fin milling machine increased the production by 35% as compared to a constant speed drive.

By Karl Stad

New Technique Cuts Milling Costs

Carbide Milling Cutters, Even Though Used in Old Equipment, Out-Perform High-Speed Steel Cutters

THE COMBINATION of a carbide and a new technique in milling—termed *Kennamilling*—is currently being demonstrated to hundreds of industrial organizations in the eastern and mid-western areas and is arousing considerable interest. Recently, more than a thousand management and production personnel representing these organizations witnessed these demonstrations of a radically new method of milling in the Wm. Sellers plant, in Philadelphia. The new technique was applied to a large variety of materials ranging from steel to magnesium alloys and included armor plate, Meehanite and semi-steel cast iron.

Sponsored by Kennametal, Inc., of Latrobe, Pa., these demonstrations were possible through the cooperation of the Wm. Sellers Company and the Sundstrand Machine Tool Company of Rockford, Illinois. In addition to suitable factory space in the Sellers plant, the latter organization also made available a No. 5 horizontal bar and a Brown & Sharpe 7½ H.P. horizontal knee-type milling machine. The Sundstrand Machine Tool Company provided a heavy duty 25 H.P. Rigidmill and a 25 H.P. high spindle speed Rigidmill.

Kennametal moved a 55 H.P. Milwaukee C.S.M. vertical milling machine to the Philadelphia Sellers plant for these demonstrations. Thus, there was more than 100 H.P. available for these milling demonstrations, ranging from a standard 7½ H.P. machine to the 55 H.P. specially engineered equipment for carbide milling. In this connection, it is interesting that the Brown & Sharpe machine, used so effectively in these demonstrations, is 12 years old. Milling SAE 1040 steel at 26" per minute, on this 7½ H.P. standard knee-type miller, definitely proved that conversion to carbide need not be delayed awaiting new equipment, however desirable and more effective.

An armor plate component of a tank turret, milled with extreme difficulty during the war at ⅜" feed rate, was straddle-milled on the Sundstrand heavy duty Rigidmill at

FIG. 1. Five H.S. Steel cutters dulled and burned after removing less than 450 square inches of metal from this surface. An 8" face Kennamill, with K2S blades, removed 4000 square inches of same material on adjoining face and operated several days without reconditioning.

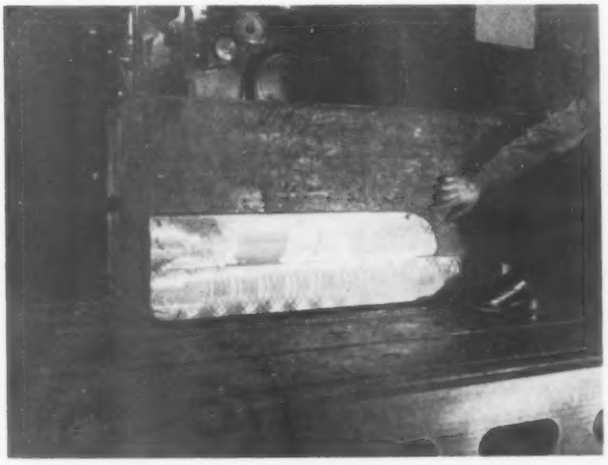


FIG. 2. Setting blades in 8" diameter face Kennamill to the shoulder of a fly cut. The O.D. of all blades have maximum run-out of .0005" by this method. Surface finishes are superior to those obtained by grinding cutters in a cutter grinder.

17" per minute. This unusually difficult operation included an interrupted cut; nevertheless, these Kennamills performed beautifully with exceptional cutter life.

The marked advantages of this method over high speed steel were presented in the milling of a 6½ ton semi-steel cast iron component set up on the Sellers No. 5 bar. Five high speed steel cutters were dulled in taking less than one and a half passes in attempting to clean up the sandy, chilled surface in preparation for the Kennamills for which this operation had been considered too difficult. An 8" Kennamill not only took over at this point, cleaning up this difficult surface but continued in operation, pass after pass, without regrinding. The increase in the feed rate from 1.8" to 20" after conversion from high speed steel was just one additional justification of this technique.

One hundred cubic inches of Meehanite per minute was removed by an 8" Kennamill installed on the 55 H.P. Milwaukee C.S.M. After a cut 5" wide by .400 inches deep was taken at 50" per minute a profilometer reading showed a 30 micro-inch surface. As a remarkable demonstration milling Dural at 150" feed rate and a magnesium alloy at 300" feed rate was performed on the Sundstrand high speed Rigidmill.

The surface foot rates for both these operations was 6,300 feet per minute. In spite of the high chip loads—.006 inches and .012 inches respectively—the micro-inch finish according to a profilometer reading was less than 10.

FIG. 3. A 6½ ton semi-steel cast iron casting being milled on a No. 5 Sellers Bar. Surface foot rate 210 F.P.M.; feed 20", depth of cut 5/16"; chip load .025 inches; H.P. 25; micro-inch surface 30 to 40.

FIG. 4. Excellent surface condition of semi-steel cast iron casting milled by 5/16" deep at 20" (.025" C.L.) indicated by 30 micro-inch reading. Possibility of matching 5" wide cuts also apparent from this illustration.

FIG. 5. Grinding solid carbide blades in grinding block on surface grinder. All angles, both cutting and clearance, are included in this grinding block.

The design and manufacture of a precision tool holder in the form of a cutter body and the development of a new grinding technique using a grinding block made possible demonstrations in a radically new method of grinding and blade setting. Blades of solid carbide 5/16" x 5/16" x 2½" were ground in a grinding block which incorporated all angles, both cutting and clearance. The grinding was performed on a small bench type surface grinder equipped with a magnetic chuck and a 220 grit diamond wheel 6" in diameter with 3/8" wide face.

The 8 blades in an 8" diameter face Kennamill were set to the shoulder of a fly cut, taken with one of these blades, in less than five minutes. A cut taken with a face mill so set immediately following the blade setting demonstration proved that milling can be done with exceptionally good finishes using this new technique.

High Frequency Heating Lab.

A NEW HIGH FREQUENCY HEATING laboratory was recently opened in Los Angeles, by *Westinghouse Electric Corp.*, for the purpose of aiding the western industries in solving their induction problems. Induction heating is being used today in the surface-hardening of gears, shafts, tools and cylinders; brazing of parts in a production process; soldering of cans and bushings; melting of high quality metal alloys; annealing of metal tubing and sheet; heat treating of pipe welds. The illustration shows a high frequency oscillator coil.

By A. E. Rylander

Tools of Today Meet Tomorrow's Demands

Ultra-Modern Precision Tools, with Electronic "Brains" Supplementing the Human Element, Portend High Production with Maximum Control of Quality

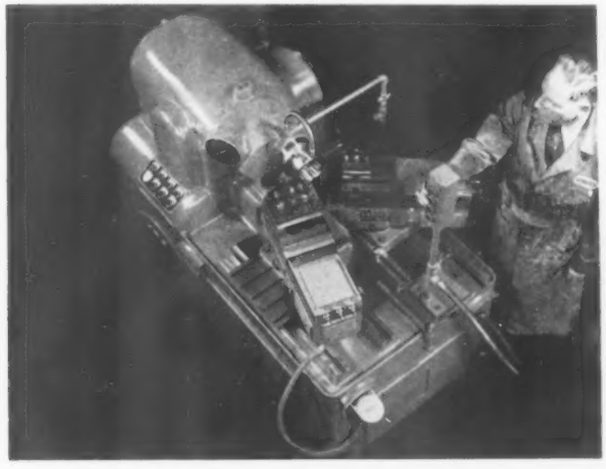
TAKING FULL ADVANTAGE of late developments and ultra-modern manufacturing techniques, as well as of experience gained in intensive war production, the Monarch Machine Tool Company, Sidney, Ohio, has greatly improved a line of machine tools long known for precision and refined workmanship. This improvement is equally apparent in the product and in the tools and methods for manufacture—in fact, throughout the plant which, in layout and equipment, compares favorably with the best in the machine tool field.

While a lay observer—i.e., one unversed in engineering and manufacturing practices—might regard the overall picture as "reconversion," that term would be a misnomer and would imply a previous and marked deviation from the regular line of product. And, like a good shoemaker, Monarch stuck to its last, turning out good machine tools as its principal product.

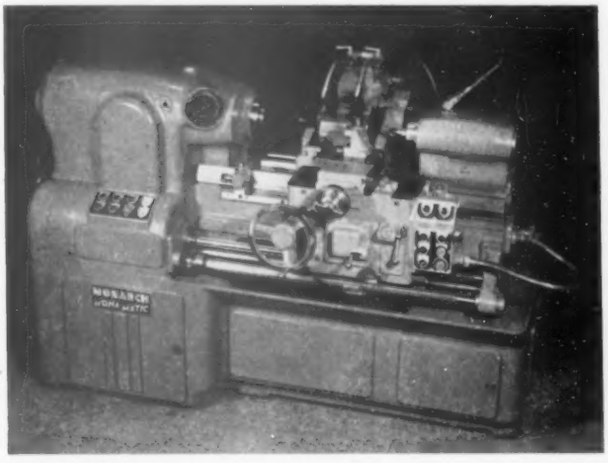
"Reconversion," then, boils down to expanded plant facilities and improved methods of manufacture and materials handling. And here, the experienced tool engineer would find many items of interest—the control of quality from raw material to finished product, the best in modern machine tools, jigs and fixtures, finishing and inspection equipment—the whole reflected in a quality product.

Of the four machines "previewed"—the *Uni-Matic*, the *Mona-Matic*, the *Mold-Makers Tool Room Lathe* and the 10" x 20" Model EE *Sensitive Precision Toolmakers Lathe*—each would have its particular appeal in the field for which it was designed. They're all engine lathes—plus.

The Uni-Matic, a new turning machine which differs radically from the conventional engine lathe, performs turning, facing and boring operations on a high production basis combined with close accuracy. Essentially, the machine consists of a simplified version of the conventional lathe bed and headstock, with motor, change gears and drive mechanism, and one or several independently (motor) driven tool slides mounted on T-slotted swiveling bases.



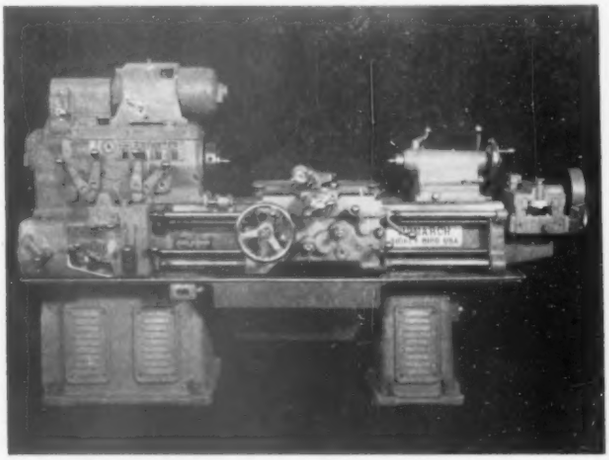
Above. "Birdseye" view of Uni-Mat, with electronic "brain" and automatic cycle compound rests.



Above. The Mona-Matic. Rugged, with high spindle speeds and instantaneous braking. This machine meets modern demands of high production with precision.

Below. The "streamlined" Monarch 10" Sensitive Precision Toolmakers Lathe, with electrical lead screw, reverse and variable speed mechanism.

Below. The Monarch Mold-makers Toolroom Lathe. Versatile, with adjustable lead screw mechanism. This tool is admirably suited to mold makers' needs.



To all practical purposes, these tool slides—termed Uni-Mats—are motor driven compound rests which can be grouped around the spindle, singly or in multiple, in whatever arrangement best suited to the job to be processed. They permit turning, facing and boring operations from almost any angle. While independently operated, however, each unit can be made to operate in absolute synchrony with the spindle, or with each other.

Singly or in group, these Uni-Mats are controlled by an electronic "brain" contained in a separate and—if so desired—a remote cabinet. This is so designed that all wiring, relays and other electrical equipment are readily accessible for maintenance inspection and for adjustment during set-up. All devices are standard design, with ample provision for overload. Chance of failure is reduced to a minimum.

It is not the purpose, here, to go into complete detail regarding these machines. All of that may be had from the manufacturer. Sufficient to say, at this time, that they are high production machines, extremely accurate and versatile and, what will appeal especially to production men, extremely rugged. It is a cost cutter, arrived at an opportune time in view of rapidly rising labor costs.

The Mona-Matic is also a new machine, specifically designed for manual or semi-automatic turning, as for first or second operations on gear blanks, straight and flanged bushings, and various types of shafts with one or more steps. The machine is provided with front and rear carriages which incorporate several automatic features; also, it has an unusually wide range of spindle speeds—75 to 3,000 rpm. As the higher is a critical speed which, in view of almost instantaneous braking, would tend to spin loose a chuck, the latter is direct mounted for safety.

Like the Uni-Matic, the carriages are provided with individual motors and with electrically controlled cycle. Feeds can be changed through pick-off gears mounted in the carriage housing. Also, like the Uni-Matic, the slides have rapid-traverse, in, at 100 inches per minute, and feed rates at from ½" to 13" per minute, with power driven rapid-traverse return to starting position.

The new Model EE 10" Sensitive Precision Toolmakers Lathe, now in production, is all that its name implies. While patterned largely after its predecessor—it retains the typical Monarch streamlined appearance—it contains a number of improvements. These include higher, sustained operating speeds and a more complete lubrication of all gears and moving parts, regardless of the operation being performed.

Particular attention has been paid to operator convenience, since it is no longer necessary to change end gears to obtain the full range of feeds and threads. A single lever, at the front of the gear box, handles the shift from belt drive, with 50 feeds, to end gearing with 60 threads.

Of particular interest to mold and die makers is a new type of universal toolroom lathe—the Monarch Mold-Makers Toolroom Lathe—which is available in size corresponding to a 12" toolroom lathe. It swings 14½" over the bed, with 30" or 54" between centers, as specified. While especially designed for mold makers, however, this machine is entirely capable of handling any work required of a conventional toolmakers lathe.

One feature is an adjustable lead screw variating mechanism which can be adjusted to compensate for the shrinkage of the material to be molded. Should the shrinkage be 3 per cent, or as little as .001" per inch, it can be accurately compensated for. Another feature, to suit miscellaneous internal and external milling operations, which must be performed with the mold set in the lathe, is a speed reducer which may be connected at will and which permits speeds as low as a fraction of a revolution per minute.

Taken as a whole, these machines invite the fullest consideration of the progressive tool engineer and production executive, and descriptive literature is available on request. One feature of these machines, and which indicates how closely the Monarch organization has followed modern trends, is the adoption of "oil-mist" lubrication.

Brought out in Sweden during the latter part of the war, to offset a shortage of lubricating oils, and but little publicized in the States this method of lubrication not only effects a considerable saving in oil, but results in a marked reduction in operating temperatures. Apparently, the Monarch organization has overlooked few if any innovations tending to improved performance of its tools.

More Jobs Through Better Tool Engineering

The American Society of Tool Engineers **"New Era" Exposition,** scheduled for April 8 to 12 in Cleveland's Public Auditorium, has been planned with the express intention of demonstrating the contention that the creation of more jobs is inseparably linked with better tool engineering.

"Full employment is of vital concern to the entire nation," states C. V. Briner, A.S.T.E. President, "for it is one of the very cornerstones of our economy. A high level of production automatically brings a high level of employment, and assembled in this show will be an array of industrial equipment capable of instituting and maintaining an era of great productivity.

"Competition and profit are the main driving forces of industry's constant striving to offer better things at lower cost to more people. Mass production, the special province of the tool engineer, has followed this route in producing the highest standard of living the world has ever known. Devising feasible means of producing more goods at prices within the average individual's purchasing ability is the prime objective of tooling.

"As effectively engineered tooling increases production and cuts manufacturing costs, product prices scale downward, larger segments of the population enter the market, sales volume spirals upward and a rise in gainful employment closely follows the sales trend. Most industrial leaders are in complete agreement that this is the way—and the only way—to full employment," Briner concluded.

The New Era Exposition will present a resume of the most important technical advances of the war-spurred years and will cover comprehensively all fields related to production. Leading manufacturers of tools, materials handling equipment, control systems activated by pneumatic, hydraulic, electrical and electronic means, coolants, lubricants and inspection instruments have currently reserved approximately one-half of the exhibit space. A floor plan of the Auditorium, indicating show areas not already reserved, may be obtained from A.S.T.E. headquarters, Penobscot Building, Detroit 26, Michigan.

NOTICE TO ASTE MEMBERS

Difficulty in securing delivery of 1946 Membership Cards has delayed National Headquarters in issuing them to members. As soon as the cards are received from the printer, they will be mailed in acknowledgment of the current year's dues.

GADGETS

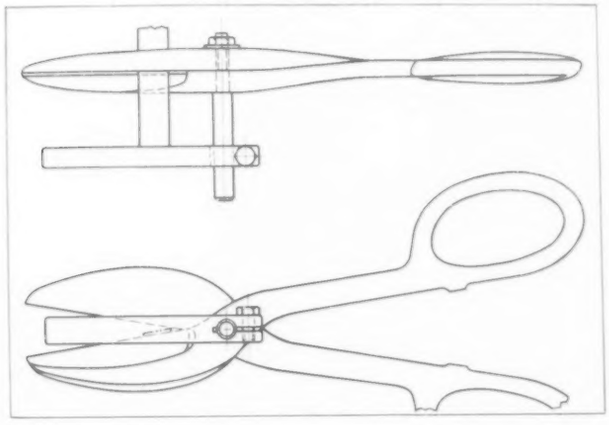
Ingenious Devices and Ideas to Help the Tool Engineer in His Daily Work

Slot Gage for Metal Shears

THIS "gadget" is very simple to make, yet very useful, especially when short orders are to be filled, or for layout and experimental work. The sketch is so obvious that detailed explanation seems unnecessary. The pin, of course, should be made of tool or alloy steel, hardened and tempered. The length of the large diameter can be made to suit, as can the adjustable gaging finger.

While not so shown, it would be well to mill flats on the large diameter, close to the shear, for wrench grip when tightening the nut.

Frank J. Peragine,
Greater New York Chapter,
A.S.T.E.

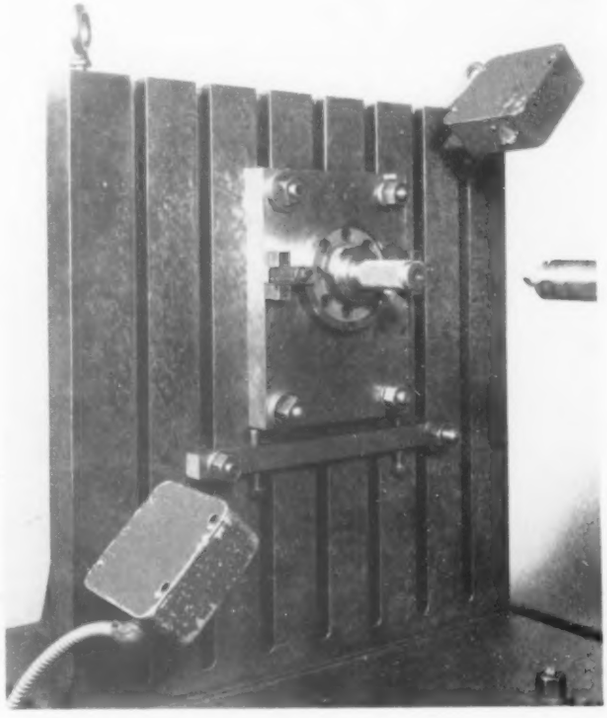


"Electric Eye" Promotes Safety

AN INTERESTING application of the "electric eye," to promote plant safety, is shown in the photograph, taken at Michigan Tool Company, Detroit. A Simplex Borematic is set up to finish bore a blank for a high precision Cone-Gear drive.

The photo-electric cell is mounted on the universal face plate of the machine. As arranged, the boring tool cannot move toward the workpiece as long as the aligning plug is in position or even while the operator is removing the plug. The light beam of the "eye" is interrupted by this plug, the circuit being so arranged that the machine cannot be started while the plug is in place.

Contributed.

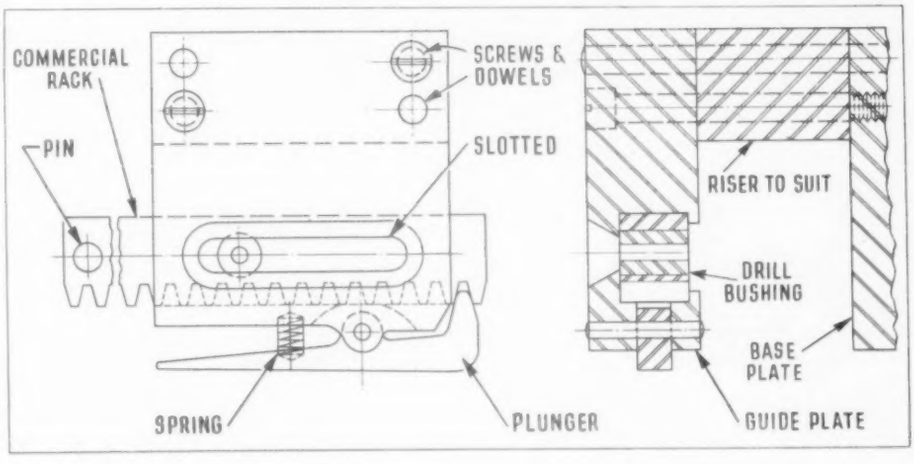


Simple "Index" Drill Jig

AN ADEQUATELY ACCURATE drill jig, for drilling holes that break into each other (as when "drifting" out slots) can be made by using standard commercial rack sections for indexing between holes. This obviates expensive jig boring. For example, a 32 pitch rack would provide .098" spacings, suitable for drills 1/8" approximate. By skipping one or two teeth, spacings could be .196" and .294", suitable for 7/32" to 5/16" drills.

The layout is merely suggestive, and the "gadget" could be varied to suit requirements. Naturally, a suitable Vee or other locator would be used, to align work under the bushings. The drill bushing would have to be small enough to suit the width of the rack; however, the rack could be attached to the slider. A pin (shown at left) acts as a stop and as a handle for indexing. The plunger can be round nosed, as the spring would keep the rack from slipping.

Contributed.



The Elements of Gearing

No. 5 of a Series

Throughout this series, the intent has been to outline the elements of gear manufacture in such simple terms that a lay reader would have a practical understanding of the art. From the information given, he should be able to lay out and make gears that, if not super-accurate, would at least run together, with reasonable quietness and efficiency.

Approaching gear processing from a practical angle, the mathematics have been subordinated to the methods of layout and manufacture. We now take up the calculation of gears, but this, too, is outlined in simple terms. When this series is concluded, the reader, who has followed it from the beginning, should have a sound working knowledge of most of the elements involved.

Ed.

GEAR CALCULATIONS

Definitions of Gear Elements

Center Distance: The center distance is the distance between the centers of a pair of mating gears.

Pitch Circle: The pitch circle is the circle that represents a smooth disk that would transmit, by friction, the desired relative motion.

Diametral Pitch: The diametral pitch is the ratio of the number of teeth to the pitch diameter of a gear. It represents the number of teeth per inch of pitch diameter. "Pitch" is used in formulae for diametral pitch.

Circular Pitch: The circular pitch is the length of an arc of the pitch circle that corresponds to one tooth interval. It is equal to the circumference of the pitch circle divided by the number of teeth in the gear. We can express the definition of the diametral pitch as,

$$\frac{\text{number of teeth}}{\text{pitch dia.}} \qquad (1)$$

and the definition of a circular pitch as,

$$\frac{\text{circumference of pitch circle}}{\text{number of teeth}} = \frac{\text{pitch dia.} \times 3.1416}{\text{number of teeth}} \qquad (2)$$

By multiplying (1) by (2),

$$\frac{\text{number of teeth}}{\text{pitch dia.}} \times \frac{\text{pitch dia.} \times 3.1416}{\text{number of teeth}} = 3.1416 \qquad (3)$$

In other words, the diametral pitch multiplied by the circular pitch equals an old Greek ratio of the circumference to a diameter, or 3.1416. If we know one pitch, we can calculate the other by means of (3).

Module: The module is the ratio of the pitch diameter of a gear with its number of teeth

$$\text{Pitch dia.} = \frac{\text{number of teeth,}}{\text{pitch}}$$

therefore,

$$\text{Module} = \frac{\text{number of teeth}}{\text{pitch}} : \frac{\text{number of teeth}}{1} = \frac{1}{\text{pitch}} \qquad (4)$$

Module = pitch diameter of a gear per tooth. (5)

Addendum: The addendum of a gear tooth is the height of the gear tooth outside the pitch circle.

Outside Diameter or Blank: The outside diameter of a gear equals the pitch diameter plus twice the addendum.

Dedendum: The dedendum is the depth of the tooth space below the pitch circle.

Clearance: The clearance is the space provided between the top of the tooth of one gear and the bottom of its mating tooth space.

Clearance = dedendum minus addendum (6)

Whole Depth: The whole depth is the total depth of the space on a gear measured radially between circles containing the tops of the teeth and the bottoms of the spaces.

Working Depth: The working depth is the depth that the teeth of one gear extend into the spaces of its mating gear. It is equal to the sum of the addenda of mating gears. In other words, the working depth is equal to the whole depth minus the clearance.

Angle of Action: The angle of action is the angle through which one tooth travels from the time it first makes contact with its mating tooth on the line of action until it ceases to be in contact.

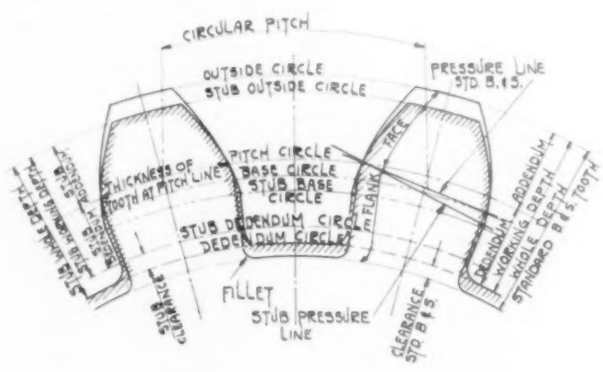
Line of Action: The line of action is the line along which correct contact between mating teeth is made, which results in the transmission of uniform motion from one gear to the other.

Base Circle: The base circle of an involute is the circle from which a line would be unwrapped to develope the involute curve.

Practically all foregoing terms are illustrated in Fig. 1.

Let P — diametral pitch
N — number of teeth
C — circular pitch
D — pitch diameter
M — Module

Example 1. For a gear having 26 teeth, diametral pitch 4, 14½-deg. full-depth tooth and composite form of basic rack which corresponds to Brown & Sharpe system:



$$D = \frac{N}{P} = \frac{26}{4} = 6.500'' \quad (7)$$

$$\text{Addendum} = \frac{1}{P} = \frac{1}{4} = .250'' \quad (8)$$

$$\text{Dedendum} = \frac{1.157}{P} = \frac{1.157}{4} = .289'' \quad (9)$$

$$\text{Whole Depth} = (8) + (9) = \frac{2.157}{4} = .539'' \quad (10)$$

$$\text{Outside Dia. or Blank} = \text{Pitch Dia.} + 2 \times \text{Addendum} = 7.000'' \quad (11)$$

$$\text{Circular Pitch} = \frac{3.1416}{4} = .7854'' \quad (12)$$

$$\text{Thickness of Tooth on Pitch Line} = \frac{\text{Circ. Pitch}}{2} = .3927'' \quad (13)$$

The dimensions needed by a shop and inspection division are shown in the foregoing calculations.

20-deg. STUB-TOOTH GEAR SYSTEM

This system increased the pressure angle from 14½ deg. and reduced the tooth height, thus employing different tooth proportions.

Several different stub-tooth systems are in use, most of them with a pressure angle of 20 deg. but with slightly different tooth heights.

FELLOWS STUB-TOOTH GEARS

The diametral pitch of the Fellows stub tooth is expressed in the form of a fraction. The diametral pitch 4/5 indicates that—5—is used for calculations of addendum, dedendum, clearance, and gear blank, and—4—for pitch diameter. The tooth is shorter and stronger below the pitch circle, as is shown in Fig. 1.

Example 2. A stub-tooth gear has 26 teeth and 4/5 pitch.

$$\text{Addendum} = \frac{1}{P} = \frac{1}{5} = .200'' \quad (14)$$

$$\text{Dedendum} = \frac{1.250}{P} = \frac{1.250}{5} = .250'' \quad (15)$$

$$\text{Whole Depth} = \frac{2.250}{5} = .450'' \quad (16)$$

$$\text{Clearance} = \frac{.250}{5} = .050'' \quad (17)$$

$$D = \frac{N}{P} = \frac{26}{4} = 6.500'' \quad (18)$$

$$\text{Blank} = 6.500 + \frac{2}{5} = 6.900'' \quad (19)$$

$$\text{Circular Pitch} = \frac{3.1416}{4} = .7854'' \quad (20)$$

$$\text{Thickness of Tooth on Pitch Line} = \frac{.7854}{2} = .3927'' \quad (21)$$

A sectional committee of the American Standards Committee adopted as a tentative 20 deg. stub-tooth form with the following proportions:

$$\text{Addendum} = \frac{.800}{P} = .800\ M \quad (22)$$

$$\text{Dedendum} = \frac{1.000}{P} = 1.000\ M \quad (23)$$

$$\text{Working Depth} = \frac{1.600}{P} = 1.600\ M \quad (24)$$

$$\text{Whole Depth} = \frac{1.800}{P} = 1.800\ M \quad (25)$$

$$\text{Clearance} = \frac{.200}{P} = .200\ M \quad (26)$$

$$\text{Blank} = \frac{N + 1.600}{P} \quad (27)$$

$$\text{Pitch Dia.} = \frac{N}{P} \quad (28)$$

$$\text{Root Dia.} = \frac{N - 2.000}{P} \quad (29)$$

$$\text{Circ. Pitch} = \frac{3.1416}{P} \quad (30)$$

$$\text{Thickness of Tooth on Pitch Line} = \frac{\text{Circ. Pitch}}{2} = \frac{1.5708}{P} \quad (31)$$

This form will interchange with all the existing 20 deg. stub-tooth systems. The differences in tooth heights affect only the clearance.

Example 4. Using—4—as a diametral pitch of 26-tooth Fellows gear,

$$\text{Addendum} = \frac{.800}{4} = .200''$$

$$\text{Dedendum} = \frac{1.000}{4} = .250''$$

$$\text{Whole Depth} = \frac{1.800}{4} = .450''$$

$$\text{Blank} = \frac{26 + 1.600}{4} = 6.900''$$

The results are the same as (14), (15), (16) and (19) without the necessity of using the—4/5—pitch.

STRAIGHT TOOTH BEVEL GEARS

Shop Requirements. The following information is needed by a gear production department:

1. Number of teeth
2. Diametral pitch
3. Whole depth of tooth
4. Thickness of tooth
5. Pitch cone angle
6. Blank angle
7. Cutting angle
8. Outside diameter

Note. The same symbols are used as for spur gears.

Example 3. Given: Gear 35 teeth, 4 pitch and pinion 20 teeth, 4 pitch.

CALCULATIONS FOR THE GEAR

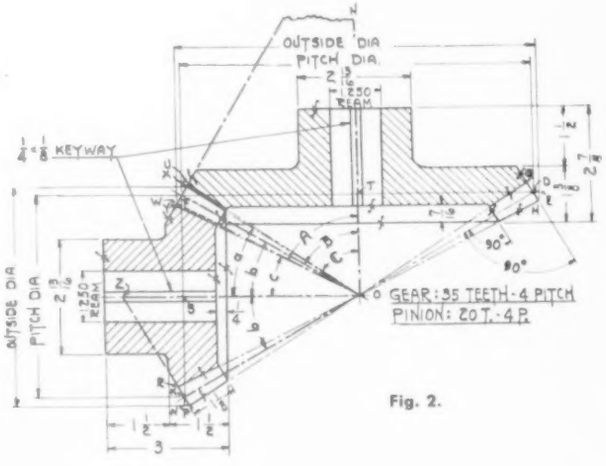


Fig. 2.

$$\text{Pitch Dia. } D = FD = \frac{35}{4} = 8.750'' \quad (32)$$

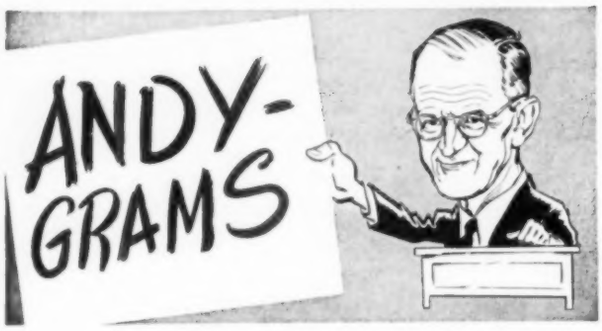
$$\text{Addendum } DH = \frac{1}{4} = .250'' \quad (33)$$

$$\text{Dedendum } DQ = \frac{1.157}{4} = .289'' \quad (34)$$

$$\text{Whole Depth } HQ = \frac{2.157}{4} = .539'' \quad (35)$$

Pitch Cone Angle TOF,

Next, in this Series, will be the Calculation of Bevel Gear and Pinion, and Worm Wheels



"LITTLE BY LITTLE the acorn grew," as the poet said of the oak, and that applies patly to THE TOOL ENGINEER which, *transplanted* a year ago, has grown vigorously during the twelvemonth. True, we've had our trials. Starting from scratch with a skeleton staff—and that scattered and "doubling in brass"—we had barely enough material to make the February '45 book.

But, that's all in the past—I hope. Over the year, we've built up an organization that, while still somewhat inadequate to an inordinate load, makes up in good will and cooperation what it lacks in numbers. And of material, there is a constant flow from authoritative sources, this including "repeats" from top flight authors who have placed THE TOOL ENGINEER high on their preferred lists. Barring occasional lapses—and they're getting fewer—THE TOOL ENGINEER has progressively been molded into a design that, by now, has become a pattern for emulation in the technical publications field.

What applies to the *Journal* also holds for the Society; that, too, is being "remolded nearer to the heart's desire." For one thing, the incumbent Exec. Com'tee—which includes sound and seasoned business men—has effected reforms that, even now, are showing marked economies in the operation of the Society. Eventually, this will be reflected in a greater service to the members.

For another thing, the new constitution now makes the A.S.T.E. a truly democratic organization in which every Chapter has equal representation through its representative in the House of Delegates. The House will elect the Directors, each of whom must have the stamp of approval of the majority of members, as determined either by "straw vote" at the various Chapters or by majority vote of the Delegates.

Personally, I'd be hard put to name the "10" among the 20 nominees. I know these men, and I like them. Yet, considering their outstanding business ability and leadership, and their years of work in the Society's behalf, Al Sargent and Brad Peirce should have the unanimous vote of the Delegates. Failure to re-elect these men, who are in direct line for the presidency, would be an irreparable loss to the Society.

Also, in view of their records and marked ability, Irwin Holland and Carl Holmer should receive the fullest consideration for the Directorate. Holland is sound presidential timber, and election to the Board would be tantamount to a badge of merit long deferred. And largely, that holds for Cal Holmer. Like still waters, these men run deep.

Of the Canadian nominees, both Bill Dawson and Bob Douglas have made their mark, and whichever is elected the other is sure to be retained on Nat'l committees. As for new blood, my personal choice would be Grant S. Wilcox, Jr., ass't master mechanic at Plymouth Motors and past ch'man of Detroit Chapter. Grant has not only shown outstanding administrative ability in industry and as a Chapter officer, but has also made an indelible impress as a committee worker, currently on the Nat'l Standards Com'tee.

Furthermore, Grant has attended a number of Directors' meetings, pinch hitting for the regional Director in the latter's absence. Because of his matured approach and broad grasp of Society affairs, he made an excellent impression at the meetings. Incidentally, it may interest you boys North, East, West, South that Grant has crashed big time as a writer. A story of his—"You Can Afford to Fly"—is scheduled to appear in March *Esquire*. Better order your copy now.

Now, having named my personal choice, but without prejudice and with the best interests of the Society in mind, I'll leave the rest of the slate to my fellow members—and the best of luck all around!

I've had little time for visiting, the past year, but on occasions I get around to Society H.Q. in the Penobscot Bldg. And each time, improvements stand out like a beacon. Gradually, I'm getting acquainted with our new Exec. Sec'y, Harry Conrad, and the guy fits like a glove shaped to the hand. He'll do! Right now, he is hard at it getting ready for the **New Era Exposition**, and he is handling that in masterly fashion. While passing out deserved compliments, I also want to pin a bouquet on Truman (Doc) Nelson, in charge of mailing at H.Q. Doc is doing a swell job and is practically master mechanic of the "plant."

Managed to get around to Detroit Chapter meeting in January, and was particularly pleased to hear Andy Carnegie mention Ot Winter and Ed Dickett among the "Who's Who in the A.S.T.E." It's nice to note that these hard workers in the Society are remembered, and that absence "makes the heart grow fonder." Me, I was called out on urgent business during the meeting, and when I got back they'd elected me to a com'tee. And I haven't a thing to do! At that, I appreciate the friendliness that prompted the appointment. I'll go to work!

Jan. 22, trekked to Sidney, Ohio, the occasion being a press preview of Monarch Machine Tool Company's latest line of precision toolroom and production lathes. Fine tools! —comparing favorably with the best in the field. Like most old line manufacturers, Monarch "stuck to its last" but with considerable advantage as a result of technique developed during the war.

The score or so of attending scribes included Eric Oberg of *Machinery*, Guy Hubbard of *Steel* and Howard Campbelil, of *Modern Machine Shop*, whom I've been wanting to meet for some time. Also, ASTE'ers Eric Crawford of *Canadian Machinery*, Willard Pennington of *Tool & Die Journal*, Paul Reed of *Industrial Plastics*, and H. E. (yclept Jim) Linsley of *Iron Age*. Jim, by the way, has succumbed to the gun collecting fever, but rallied as a result of my expert diagnosis. Incidentally, W. E. Whipp, Monarch's prex, has one of the finest Kentucky rifles I've yet to fondle.

Detraining, was met by a one-man reception com'tee—Len Church of Hill & Knowlton, Cleveland—who immediately made all hands feel at home. Swell guy! For that matter, the entire Monarch personnel vied in making things pleasant for the visitors. It's a friendly organization, and the biggest industry in the city. And Sidney's a nice li'l town that, with nice, friendly people, should enjoy a certain immunity to the fever that is now disrupting industry.

Going home, got a ride all the way to Detroit with Peirce Lewis, local *Iron Age* representative who, in a few hours, made me feel as though I'd known him all my life. And now, work piling up, I'll say *Au Revoir* 'til we meet again.

Andy

A.S.T.E. NEWS

NEWS OF INTEREST AND ABOUT MEMBERS

New Production Developments to Have Premiere at Society's Exposition

INDUSTRIAL EQUIPMENT, never before shown, will be previewed by visitors to the ASTE New Era Exposition in the Cleveland Public Auditorium, April 8-12. New exhibitors, as well as companies who have participated in the Society's four previous shows will comprise the more than two hundred nationally-known concerns who will display their peacetime products and services.

Here, the Tool Engineer and those in related production capacities will inspect the latest engineering developments, production processes, materials handling and control equipment, cutting tools, gages and other devices to convert raw materials into the amazing new consumer goods for which a long-denied public is eagerly waiting.

Brisk Demand for Space

Reservations for the first, full-scale ASTE show since 1941 are rapidly absorbing the extensive facilities laid out for exhibits. Assignments are being made for areas ranging from 10′ x 12′ to 32′ x 70′. Booths have been planned with a view to eliminating dead corners and inaccessible areas, making all sections of the exhibit halls equally desirable.

Attractive standard booth equipment will be furnished, curtained with a neutral green rep, accented at the back with a center panel of silver rayon. The eight-foot columns in the rear and the yard-high newel posts supporting the partitioning draperies will be black with chrome trim. Surmounting each booth will be a 12" x 44" sign frame for the exhibitor's name which will be readily discernible.

Service Bulletin Issued

Services available to exhibitors, such as piping, compressed air, gas, furniture, rigging, trucking, freight and express handling, and labor are described in a brochure issued early this month.

* * *

Paralleling the theme of the physical presentation, eminent speakers will explain, in a series of technical sessions, how to utilize to the best advantage modern production equipment and processes. The technical program, directed by National Program Chairman H. D. Hall, will open Monday afternoon, April 8, with a symposium on Plant Layout and Materials Handling. This session, to be chairmanned by W. B. McClellan of Detroit, will include a film showing materials handling in an ordnance plant.

In the evening Stephen Urban of Syracuse will preside over a discussion of "Controlling Quality," incorporating statistical quality control and tolerances, combining physical, dimensional and economical standards.

To Consider Coolants

What every tool engineer should know about coolants will be divulged at the Tuesday afternoon session, chairmanned by F. J. Schmitt of Chicago.

On Tuesday evening, several speakers will reveal new techniques in cutting tools, describing cutters, cutter materials and cutter uses. R. W. Ford of Pittsburgh will take charge of this meeting.

Topic for the Wednesday afternoon lectures will be "Permanent Molds and Extrusions." E. V. Johnson of Dayton will introduce the speakers who will explain three factors—product, tools and their uses.

Students and educators, as well as

Attractive standard booth equipment to be furnished ASTE Exposition exhibitors is shown at upper left. Curtains are of green rep with center panel of silver rayon. Posts are black with chrome trim. Various booth treatments employed at the 1943 show in Milwaukee are seen in the surrounding photos.

In This Issue

members of the profession are invited to the Symposium on Tool Engineering Education and Professional Development to be held Wednesday evening under the supervision of National Education Chairman O. W. Winter.

Dean C. E. McQuigg of the College of Engineering, Ohio State University, will present his views on higher learning in engineering. Prof. O. W. Boston of the University of Michigan College of Engineering will discuss Tool Engineering Research. Tentative speakers may include a representative from the Institute of Production Engineers in England.

Engineering for Profits

"The Tool Engineer and Profits" is the subject scheduled for Thursday afternoon. Authorities to be presented by H. E. Linsley of Newark will detail the most efficient procedure for making the required number of acceptable parts at minimum cost.

An outstanding national figure is expected to give the principal address at the Annual Dinner and National Membership Meeting Thursday evening.

Concluding technical meeting on Friday afternoon will be devoted to "Special Machine Design," including driving units and basic machine design, as well as hydraulic, electronic and mechanical machine control. R. E. Lockridge of Richmond, Ind., will serve as chairman.

In addition to the session chairmen, E. W. Baumgardner of Cleveland and E. R. Murphy of Newark are assisting Mr. Hall in the development of the technical program.

* * *

Local physical arrangements are in the capable hands of J. I. Karash, Chairman of ASTE Cleveland Show Committees. His committee chairmen are: J. R. Fitzsimmons, Banquet; R. E. Harrold, Technical Meeting Arrangements; H. E. Peiffer, Plant Tours; E. W. Baumgardner, Technical Films; Richard Miller, Reception; and William Reiff, Jr., Accommodations.

Other Events Planned

Mr. Karash reports that there will be a showing of technical films, and tours of leading Cleveland plants each day of the show. Final selection of the companies to be visited is contingent upon the settlement of current labor problems. Adequate transportation is assured for these trips.

Members of Cleveland Chapter and other townspeople are offering the hospitality of their homes to those unable to secure hotel accommodations. According to present indications, attendance at the 1946 combined show and convention will top all ASTE records.

Notice
Early Deadline

The April issue of *The Tool Engineer* will go to press earlier than usual in order to have the magazine ready for the Cleveland Show.

Chapter news for inclusion in this issue must *reach* the ASTE News Editor by March 11. Reports arriving after that date will be deferred for publication in the May issue.

Austin Discusses Personnel Problems

Elmira, N. Y.—"Personnel Problems and Management" were explained to Elmira Chapter by Robert H. Austin, Personnel Director, International Business Machines Corporation, Endicott, and principal speaker at the Chapter's December 3 meeting.

R. H. Austin

Tool engineers, Mr. Austin termed "the heart of the corporation" in relating his first important war assignment of recruiting men to tool up his company's war production program. He illustrated his discussion with several charts suggesting means to improve health, income, and general working and living conditions for employees.

The speaker described the sequence-controlled calculator, built by I.B.M. and now at Harvard University, which computes and solves in ten minutes a problem requiring at least three months work by ordinary methods.

The audience was highly enthusiastic in praising Mr. Austin's presentation.

Two educational sound films, "Carbon —Black Treasure" and "Highway to Alaska," concluded the evening's program.

Executive Secretary Outlines ASTE Show

Detroit, Mich.—Plans for the ASTE New Era Exposition and convention in Cleveland were outlined by Harry E. Conrad, the Society's Executive Secretary, at the January 17 dinner meeting of Detroit Chapter, held in the Rackham Building.

During the meeting, First Vice-President A. M. Sargent explained the operation of the new Constitution, in connection with the election of a Chapter Nominating Committee. The Committee chosen consists of A. E. Rylander, Chairman; John Delaney and George Whitehouse.

A sports film concluded the evening's program.

* * *

The Chapter's Annual Christmas Stag Party took place December 18 in the Latin Quarter.

After dinner, the ASTE'ers were entertained by the name acts and orchestra appearing at the supper club.

Balancing Machine Mechanical Marvel

Toledo, Ohio—A weighing scale, which supports the work with rotative axis vertical and then checks the unbalance in two planes at right angles, has replaced the static balancing stand, Fred R. Bokorney, Engineer, Gisholt Machine Company, Madison, Wis., explained to the 86 members and guests who attended the December 12 meeting of Toledo Chapter.

With the information obtained from the machine and a handy chart, Mr. Bokorney added, the exact balancing weight may be determined instantly, even to the size, depth and position of the hole to be drilled.

The speaker, in his discussion of "Recent Developments in Balancing Machines," also described the more complicated dynamic balancing machine and its theory.

Using slides, he reviewed the development of balancing equipment, indicating the present trend toward a machine which will not only register the degree of unbalance, but will also show proper corrective measures.

Production Must Increase With Wages, Prout Says

Newark, N. J.—Technological developments which have made living easier and more pleasant for us have come about because we live under a system of free enterprise rather than under totalitarianism, according to George R. Prout, Vice President of General Electric Co., and General Manager of the Air Conditioning Department.

Speaking at the fifth annual Educational Night of Northern New Jersey Chapter, held at the Robert Treat Hotel on December 11, Mr. Prout pointed out that while the present wave of strikes was regrettable, it was nevertheless an indication of democracy at work.

Differences Will Be Adjusted

Quarrels, he said, occur in every family, but they are usually straightened out without too much difficulty, and so the present quarrel between labor and management will eventually be settled to everyone's satisfaction.

Wages, Mr. Prout explained, can come only from production, and any attempt to increase the worker's income without obtaining from him a corresponding increase in output must inevitably end in a collapse of our economic system.

He showed by actual figures that in most major industries only five cents of each dollar of income returned as profit to capital. Even if this were all given to labor, it would still represent only about 10% increase in pay, instead of the demanded 30%, and would unjustly deprive the investor of a fair return on his money.

More Pay for More Production

Workers' wages can and undoubtedly will be increased, Mr. Prout said, but it must be a gradual process accompanied by production increases to maintain a proper balance. Electric refrigerators he cited as an example of once-costly merchandise which has been brought within the reach of almost every family, through improved engineering and manufacturing processes.

In spite of this, however, the wages of the men who make the refrigerators have risen 100%. Using the slogan, "More goods for more people at lower cost," the speaker appealed to tool engineers to do their part in reducing manufacturing costs, thereby increasing the national standard of living.

Mr. Prout's talk was preceded by the showing of the film, "Three To Be Served." An NAM production, the motion picture portrays in simple, homely fashion the whole fundamental process of economics.

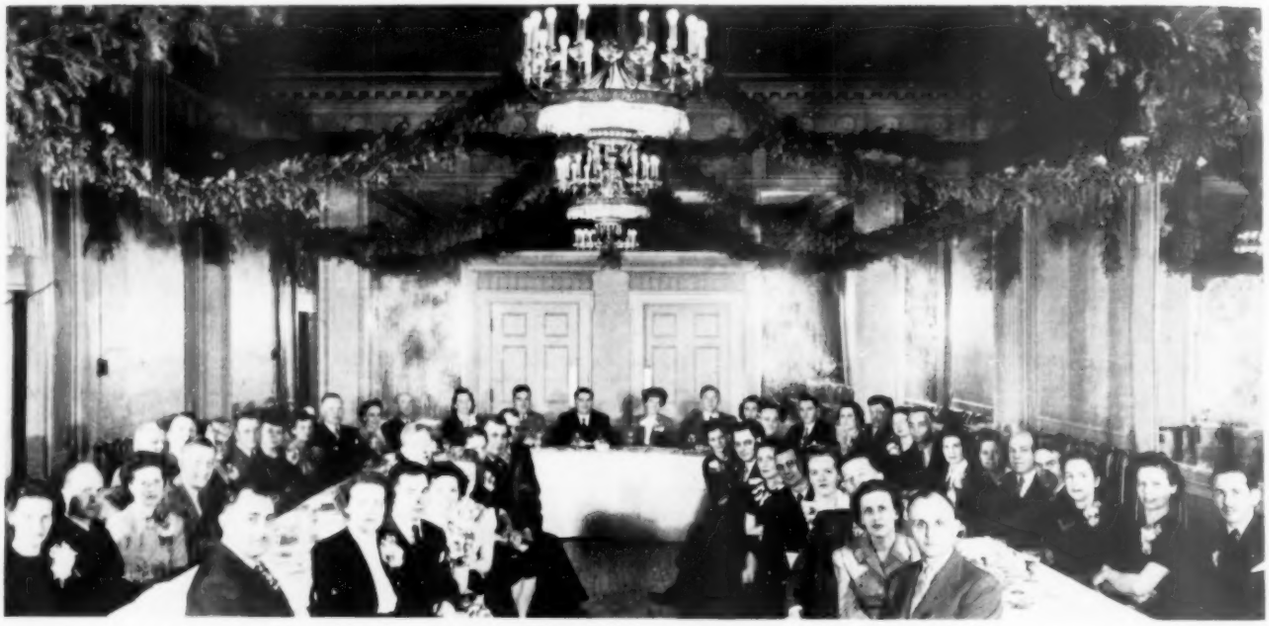
Sponsored by the Herbert Hall Foundation, the Chapter's Educational Night has become an institution. The meeting was attended by approximately 200 members and guests.

Lt. F. J. Dahlaus, U.S.N., the first member of the Chapter to return from the Armed Service was welcomed after long service in the Pacific.

Partial List of Exhibitors at ASTE Exposition

ACE DRILL CO.
Detroit, Mich.
AIR SPEED TOOL CO.
Los Angeles, Calif.
ALLEGHENY LUDLUM STEEL CORP.
Pittsburgh, Penna.
ALLIS-CHALMERS MFG. CO.
Milwaukee, Wis.
B. C. AMES CO.
Waltham, Mass.
AMPCO METAL, INC.
Milwaukee, Wis.
ANCHOR COUPLING CO., INC.
Libertyville, Ill.
ANDERSON & SONS
Westfield, Mass.
ANKER-HOLTH MFG. CO.
Port Huron, Mich.
R. B. ANNIS CO.
Indianapolis, Ind.
ARO EQUIPMENT CORP.
Bryan, Ohio
ATLAS TOOL & DESIGNING CO.
Philadelphia, Penna.
BAILEY METER CO.
Cleveland, Ohio
W. O. BARNES CO.
Detroit, Mich.
BARRETT-CRAVENS CO.
Chicago, Ill.
BAUSCH & LOMB OPTICAL CO.
Rochester, N. Y.
BAY STATE ABRASIVE PRODUCTS CO.
Westboro, Mass.
BEAVER TOOL & ENGINEERING CORP.
Royal Oak, Mich.
THE BELLOWS CO.
Cleveland, Ohio
BENDIX-WESTINGHOUSE AUTOMOTIVE AIR BRAKE CO.
Elyria, Ohio
EDWARD BLAKE CO.
Newton Centre, Mass.
HENRY P. BOGGIS & CO.
Cleveland, Ohio
BOYAR-SCHULTZ CORP.
Chicago, Ill.
BRIDGEPORT MACHINES, INC.
Bridgeport, Conn.
BROWN & SHARPE MFG. CO.
Providence, R. I.
CHARLES BRUNING CO., INC.
Chicago, Ill.
BUCKEYE TOOLS CORP.
Dayton, Ohio
CADILLAC GAGE CO.
Detroit, Mich.
CARBOLOY CO., INC.
Detroit, Mich.
CARBORUNDUM CO.
Niagara Falls, N. Y.
CHICAGO PNEUMATIC TOOL CO.
New York, N. Y.
THE CINCINNATI TOOL CO.
Cincinnati, Ohio
CIRCULAR TOOL CO., INC.
Providence, R. I.
COLONIAL BROACH CO.
Detroit, Mich.
COMPAR INSTRUMENT CO.
Detroit, Mich.
ARTHUR A. CRAFTS CO., INC.
Boston, Mass.
CROWN MACHINE & TOOL CO.
Ft. Worth, Texas
CUSHMAN CHUCK CO.
Hartford, Conn.
DELTA MFG. CO.
Milwaukee, Wis.
A. P. DE SANNO & SON
Phoenixville, Penna.
DETROIT POWER SCREWDRIVER CO
Detroit, Mich.
DETROIT TAP & TOOL CO.
Detroit, Mich.
DETROIT UNIVERSAL DUPLICATOR CO.
Detroit, Mich.
DIAMOND TOOL CO.
Los Angeles, Calif.
EUGENE DIETZGEN CO.
Chicago, Ill.
DOALL CO.
Minneapolis, Minn.
DON GAGE CO.
Detroit, Mich.
DUMORE CO.
Racine, Wis.
EAST SHORE MACHINE PRODUCTS CO.
Cleveland, Ohio
ECLIPSE COUNTERBORE CO.
Detroit, Mich.
ELGIN NATIONAL WATCH CO.
Elgin, Ill.
ENGINEERS SPECIALTIES DIV., UNIVERSAL ENGRAVING & COLOR PLATE CO., INC.
Cleveland, Ohio
ENGIS EQUIPMENT CO.
Chicago, Ill.
EUTECTIC WELDING ALLOYS, INC.
New York, N. Y.
EVEREDE TOOL CO.
Chicago, Ill.
EX-CELL-O CORP.
Detroit, Mich.
FEDERAL PRODUCTS CORP.
Providence, R. I.
FELLOWS GEAR SHAPER CO.
Springfield, Vt.
FORD MOTOR CO.
Dearborn, Mich.
FRICK-GALLAGHER MFG. CO.
Wellston, Ohio
GAIRING TOOL CO.
Centerline, Mich.
GENERAL ELECTRIC CO.
Schenectady, N. Y.
GEROTOR MAY CORP.
Baltimore, Md.
GIDDINGS & LEWIS
Fond du Lac, Wis.
GODDARD & GODDARD, INC.
Detroit, Mich.
GOVRO-NELSON CO.
Detroit, Mich.
GRAY-MILLS CO.
Chicago, Ill.
GREENLEAF CORP.
Pittsburgh, Penna.
GROB BROTHERS
Grafton, Wis.
E. F. HAGER & SON
Long Island, N. Y.
HANNA ENGINEERING WORKS
Chicago, Ill.
HANNIFIN MFG. CO.
Chicago, Ill.
HARDINGE BROTHERS, INC.
Elmira, N. Y.
A. W. HECKER CO.
Cleveland, Ohio
THE HEIM COMPANY
Fairfield, Conn.
HELLER BROS. CO.
Detroit, Mich.
HITCHCOCK PUBLISHING CO.
Chicago, Ill.
THE HOLO-KROME SCREW CORP.
Hartford, Conn.
C. B. HUNT & SON
Salem, Ohio
HYDRAULIC MACHINERY CO.
Dearborn, Mich.
ILLINOIS TOOL WORKS
Chicago, Ill.
THE INDUSTRIAL PRESS
New York, N. Y.
THE INGERSOLL MILLING MACHINE CO.
Rockford, Ill.
INGERSOLL-RAND CO.
New York, N. Y.
INTER-LAKES ENGINEERING CO.
Detroit, Mich.
THE IRON AGE
New York, N. Y.
JACK & HEINTZ, INC.
Cleveland, Ohio
JACOBS MFG. CO.
Hartford, Conn.
CHARLES L. JARVIS CO.
Middletown, Conn.
JOHNSON GAGE CO.
Bloomfield, Conn.
JONES & LAMSON MACHINE CO.
Springfield, Vt.
KENNAMETAL, INC.
Latrobe, Pa.
KNU-VISE, INC.
Detroit, Mich.
KOEBEL DIAMOND TOOL CO.
Detroit, Mich.
KYLE-JOHNSON MACHINE CO.
Los Angeles, Calif.
LAWSON-LESCHKE CO.
Royal Oak, Mich.
LINCOLN ENGINEERING CO.
St. Louis, Mo.
LIPE-ROLLWAY CORP.
Syracuse, N. Y.
JOHN E. LIVINGSTONE CO.
Detroit, Mich.
THE LLOYD GAGE & TOOL CO.
Cleveland, Ohio
LOGANSPORT MACHINES, INC.
Logansport, Ind.
LUFKIN RULE CO.
Saginaw, Mich.
LYON MACHINE CO.
Worcester, Mass.
MAC-IT PRODUCTS, DIV. STRONG, CARLISLE & HAMMOND CO.
Cleveland, Ohio
MACKLIN CO.
Jackson, Mich.
MASTERFORM TOOL CO.
Chicago, Ill.
MASTER SALES CO., INC.
Boston, Mass.
F. A. MAXWELL CO.
Bedford, Ohio
M-B PRODUCTS
Detroit, Mich.
McCASKEY REGISTER CO.
Alliance, Ohio
McCROSKY TOOL CORP.
Meadville, Penna.
MERIT MACHINE CO.
Northfield, Ohio
MICHIGAN TOOL CO.
Detroit, Mich.
MICROMATIC HONE CORP.
Detroit, Mich.
MICRO SWITCH DIV., FIRST INDUSTRIAL CORP.
Freeport, Ill.
MILL & FACTORY
Chicago, Ill.
MODERN MACHINE SHOP
Cincinnati, Ohio
MODERN PRODUCTS, LTD.
Los Angeles, Calif.
MONROE TOOL & MFG. CO.
Monroe, Mich.
MOTCH & MERRYWEATHER MACHINERY CO.
Cleveland, Ohio
MOTOR TOOL MFG. CO.
Detroit, Mich.
MUNTON MFG. CO.
Franklin Park, Ill.
NATIONAL BROACH & MACHINE CO.
Detroit, Mich.
NICHOLS-MORRIS CORP.
New York, N. Y.
NOBLE & STANTON
Bedford, Ohio
NORTON CO.
Worcester, Mass.
OISIE-TROL CORP.
Detroit, Mich.
THE O.K. TOOL CO., INC.
Shelton, Conn.
O'NEIL-IRWIN MFG. CO.
Minneapolis, Minn.
THE C. F. PEASE CO.
Chicago, Ill.
PEERLESS GAUGE CO.
Detroit, Mich.
PENTON PUBLISHING CO.
Cleveland, Ohio
PHYSICISTS RESEARCH
Ann Arbor, Mich.
PIONEER ENGINEERING & MFG. CO.
Detroit, Mich.
PIPE MACHINERY CO.
Cleveland, Ohio
PORTER-CABLE MACHINE CO.
Syracuse, N. Y.
PORTMAN MACHINE TOOL CO.
New Rochelle, N. Y.
PRATT & WHITNEY, DIV. NILES-BEMENT-POND CO.
W. Hartford, Conn.
PRECISE PRODUCTS CO.
Racine, Wis.
PRODUCTO MACHINE CO.
Detroit, Mich.
PUTNAM TOOL CO.
Detroit, Mich.
RACINE TOOL & MACHINE CO.
Racine, Wis.
RACK ENGINEERING CO.
Detroit, Mich.
RELIANCE ELECTRIC & ENGINEERING CO.
Cleveland, Ohio
REPUBLIC DRILL & TOOL CO.
Chicago, Ill.
REPUBLIC GAGE CO.
Detroit, Mich.
ROSS OPERATING VALVE CO.
Detroit, Mich.
RUSSELL, HOLBROOK & HENDERSON, INC.
New York, N. Y.
RUSTLESS STEEL CO.
Baltimore, Md.
SAGINAW BEARING CO.
Saginaw, Mich.
SALES SERVICE MACHINE TOOL CO.
Minneapolis, Minn.
SCHAUER MACHINE CO.
Cincinnati, Ohio
A. SCHRADER'S SON, DIV. SCOVILL MFG. CO., INC.
Brooklyn, N. Y.
SCULLY-JONES & CO.
Chicago, Ill.
SEVERANCE TOOL INDUSTRIES, INC.
Saginaw, Mich.
SHEFFIELD CORP.
Dayton, Ohio
SHELDON MACHINE CO., INC.
Chicago, Ill.
SHELL OIL CO., INC.
New York, N. Y.
SIMONDS ABRASIVE CO.
Philadelphia, Penna.
SIMONDS SAW & STEEL CO.
Fitchburg, Mass.
SIZE CONTROL CO.
Chicago, Ill.
SKILSAW, INC.
Chicago, Ill.
THE SKINNER CHUCK CO.
New Britain, Conn.
SNYDER TOOL & ENGINEERING CO.
Detroit, Mich.
SOCONY-VACUUM OIL CO.
New York, N. Y.
SOUTH BEND LATHE WORKS
South Bend, Ind.
STANDARD GAGE CO.
Poughkeepsie, N. Y.
STANDARD PRESSED STEEL CO.
Detroit, Mich.
STANDARD SHOP EQUIPMENT CO.
Philadelphia, Penna.
STAPLES TOOL & ENGINEERING CO.
Cincinnati, Ohio
STAR MACHINE & TOOL CO.
Cleveland, Ohio
THE L. S. STARRETT CO.
Athol, Mass.
THE STITES TOOL CO.
Cleveland, Ohio
STOKERUNIT CORP.
Milwaukee, Wis.
D. A. STUART OIL CO., LTD.
Chicago, Ill.
SUN TOOL & GAGE CORP.
New York, N. Y.
SUPER TOOL CO.
Detroit, Mich.
SWARTZ TOOL PRODUCTS CO., INC.
Detroit, Mich.
TAFT-PEIRCE MFG. CO.
Woonsocket, R. I.
G. H. TENNANT CO.
Minneapolis, Minn.
TINNERMAN PRODUCTS, INC.
Cleveland, Ohio
TRABON ENGINEERING CO.
Cleveland, Ohio
TRIPLEX MACHINE TOOL CORP.
New York, N. Y.
TUBULAR MICROMETER CO.
St. James, Minn.
TURCHAN FOLLOWER MACHINE CO.
Detroit, Mich.
UNION CARBIDE CO.
New York, N. Y.
UNITED PRECISION PRODUCTS CO.
Chicago, Ill.
VAPOR-BLAST MFG. CO.
Milwaukee, Wis.
VASCOLOY-RAMET CORP.
North Chicago, Ill.
VICKERS, INC.
Detroit, Mich.
VINCO TOOL CO., INC.
Detroit, Mich.
WELDON TOOL CO.
Cleveland, Ohio
WILSON MECHANICAL INSTRUMENT CO., INC.
New York, N. Y.
WENDT-SONIS CO.
Hannibal, Mo.
WESSON CO.
Detroit, Mich.
WETMORE REAMER CO.
Milwaukee, Wis.
WICKMAN CORP.
Detroit, Mich.
J. H. WILLIAMS CO.
New York, N. Y.
N. A. WOODWORTH CO.
Ferndale, Mich.
ZAGAR TOOL, INC.
Cleveland, Ohio

Iowa Group Entertains Ladies with Christmas Party



Beneath festoons of Christmas greenery, the first annual Ladies Night of Cedar Rapids Chapter took place December 19 in the Roosevelt Hotel. The affair, attended by 60 members and guests, opened with a banquet served in the Roosevelt Room. Corsages of vari-colored chrysanthemums were presented to the ladies. The diners were entertained with music played on an unusual electrical stringed instrument, by Eldon DeCamp. Following dinner, the group enjoyed several acts of vaudeville. Later, many of the couples danced to an orchestra, while others gathered socially in the adjoining Grant Room.

Plastics Symposium

Los Angeles, Calif. — Tool designing has reduced the cost of manufacturing dies for plastics, George A. Cooper, President, Plastic Die & Tool Corporation, told Los Angeles Chapter during his address, "Progressive Tooling for Modern Plastics," given before their December 13 meeting at Scully's Cafe.

Mr. Cooper related many of the difficulties encountered in the manufacture of dies for plastic molding. Formerly, a job was given to a toolmaker with no other instructions than to make a mold for the required part. Through engineering, many of the mistakes resulting from this method have been eliminated.

Mr. Cooper exhibited actual tools and samples of plastic products.

Gaylord E. Nichols, Technical Representative, Bakelite Corporation, explained plastics in common use and defined thermo-plastics and thermo-setting plastics, in his discussion, "An Engineer Looks at Plastics."

Mr. Nichols listed the deciding factors governing the choice of a plastic for a specific job. He cautioned, particularly, against attempting to use plastics where other materials would be more suitable.

In his opinion, the indiscriminate use of plastics has done much to injure the plastics industry.

"H.P.M. Injection and Compression Molding Machines" was the subject presented by the third speaker, Merle Barron, Sales Engineer for Machinery Sales Company. After describing plastic molding machinery, he screened a film on plastic molding, entitled, "The Shape of Things to Come."

National Director A. J. Denis reported on the Semi-Annual Meeting at Detroit. On behalf of the Chapter, Chairman A. D. Lewis presented Mr. Denis with a Past Chairman pin.

The dinner meeting was attended by 198 members and guests.

Brown General Manager For Mayle Company

Toledo, Ohio—J. P. Brown, formerly Master Mechanic at the Spicer Manufacturing Company, and a member of Toledo Chapter, has assumed new duties as General Manager of The Mayle Manufacturing Company.

J. P. Brown

Prior to his 14 years' association with the Spicer company, Mr. Brown was employed by City Machine and Tool Company, as Plant Superintendent; the Dura Company, as Foreman of the Tool and Die Department; and by the Mayle company, to which he is returning, as Plant Superintendent.

He received his technical training in evening courses at the University of Toledo.

Members Visit Headquarters

Detroit, Mich.—Among recent visitors to ASTE National Headquarters were Joseph J. Waltman of Evansville, Indiana, a member of Indianapolis Chapter, and George A. Rieke of Chicago.

Mr. Waltman, who has been an active ASTE booster in the Evansville area, reported mounting interest in that section. Mr. Rieke dropped in to inquire about the new membership certificate which will soon be available to ASTE'ers. Difficulties in securing rag paper stock, gold leaf, and adequate packaging materials have delayed this project.

Both visitors were escorted through the National Offices where they saw the recently-installed mechanical equipment for simplifying office routine.

Atom-Smashing Scientist Demonstrates Radar

Springfield, Mass.—A demonstration of the applications of Radar—both in war and peace—was presented to Springfield Chapter, December 10, by Dr. W. E. Shoupp, Manager, Electronics Department, Westinghouse Electric Corporation, East Pittsburgh, Penna.

Dr. Shoupp was the principal speaker at "Westinghouse Night" held in the Hotel Highland. In discussing "Principles of Radar Operation," he used a newly-completed Radar set to light a fluorescent tube at a distance of several feet, to ignite steel wool fibers of resonant frequency, and to demonstrate the reflective powers of the Radar beam which proved so effective in the detection of enemy aircraft and submarines.

During the war Dr. Shoupp directed the development of the Resnatron, a powerful microwage tube used to jam German night-fighter Radar sets.

He has distinguished himself also in the field of atom-smashing and associated nuclear physics problems, contributing important applications.

Another Westinghouse speaker, P. E. Stewart, Service Supervisor, explained the "Principles of Refrigeration." With a cut-away model, he showed how the unit in a mechanical refrigerator produces cold by extracting heat.

The boiling action of the refrigerant—its transition from liquid to vapor and reversion to liquid again—were visible through the plastic evaporator and glass tube sections of the demonstrator.

As further illustration, Mr. Stewart screened, "Unsung Heroes," a sound film in color, detailing the care exercised throughout the development and manufacture of household refrigerators, to insure uniform high quality.

An attendance of 177 enjoyed the extremely interesting program.

Research Men Talk On Shot Peening

Toledo, Ohio—Prof. H. F. Moore, Consultant for The American Foundry Equipment Company, Mishawaka, Ind., and John C. Straub, who directs research in shot peening for the same company, presented an interesting program on shot peening at the January 9 meeting of Toledo Chapter.

The speakers explained, among other things, how a test specimen is checked to determine the amount of peening done, the effect of shot peening on a surface, and the application of the process to aluminum, bronze, iron, malleable iron, and non-ferrous parts.

Messrs. Moore and Straub discussed their phases of the subject very clearly and capably. Distribution of Prof. Moore's booklet, "Shot Peening and the Fatigue of Metals," provided the audience with additional engineering data.

A stimulating general discussion followed the speakers' joint, slide-illustrated lecture.

Prof. Moore has taught engineering subjects in several universities, including the University of Illinois where he did extensive research on the fatigue of metals. Since his retirement, he has been conducting experiments in shot peening for The American Foundry Equipment Company.

Mr. Straub was associated with the Research Division of General Motors Corporation for a number of years, working on a variety of mechanical problems, including methods of analyzing various types of gearing. He spent several years with this organization, conducting fatigue tests in connection with shot peening, and correlating fatigue results with the various phases of the shot peening process.

More than 100 members of Toledo Chapter attended the dinner meeting.

Powder Metallurgy Expert Shows Fabricated Parts

Fort Wayne, Ind.—Technical speaker at the December 12 meeting of Fort Wayne Chapter was Douglas B. Martin, Sales Manager, Amplex Division, Chrysler Corporation, Detroit.

Mr. Martin, a Massachusetts Institute of Technology graduate with a wide background in the field of powder metallurgy, gave an illustrated lecture on this subject.

D. B. Martin

B. H. Ratts

An extensive display of powdered metal products, including bearings, machined parts, cold and bar stock, and filters, was exhibited. After showing slides of various applications of these products, Mr. Martin conducted a lively and informative open discussion.

Bruce H. Ratts, Chief Engineer, Westinghouse Radio Stations, WOWO and WOWO-FM gave a fascinating description of "Behind the Scenes in a Radio Station," illustrated with the film, "On the Air." The approximately 80 members and guests present viewed, in this production, the growth and history of radio from its origin in the garage of Dr. Frank Conrad to the latest developments in television and frequency modulation.

Ohio Group Visits Engineering Plant

Columbus, Ohio—Members of Columbus Chapter enjoyed the hospitality of the Denison Engineering Company during a tour of this plant recently.

After a dinner served in the company's dining room, the ASTE'ers were escorted through the plant. Returning to the salesroom, they were officially welcomed by W. C. Denison.

Samuel Orr, a Chapter member, gave a short talk on "Tooling for Multipress Production," outlining present problems and future plans.

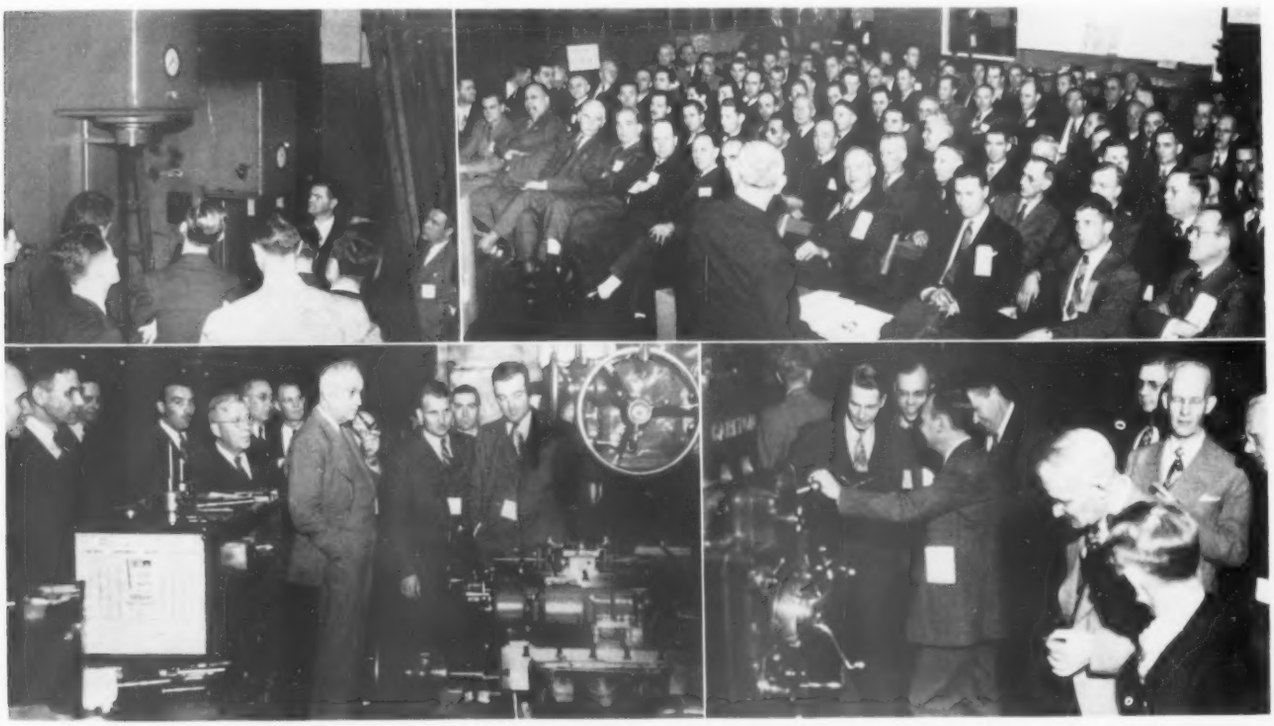
Following Mr. Orr, Howard Levenhagen presented a paper on "Standard Multipress Actions and Possible Auxiliary Controls," dealing with standard valve actions and special action controls obtainable to meet specific operational needs. There were accompanying demonstrations on the various presses in the showroom.

Paul W. Norris spoke next on "Multipress Applications." His discussion included examples of work applications and commercial tooling setups.

At the conclusion of his remarks, W. K. Carter opened the meeting for general discussion of the various phases of the Multipress. Many questions were asked from the floor and readily answered by members of the staff.

Thomas D. Detherow, Sales Engineer, Bryant Chucking Grinder Company, Springfield, Vermont, spoke briefly on internal grinding problems at the January 9 meeting.

The accompanying film, "Tooling for Better Internal Grinding," showed many aircraft setups of through and blind holes, and contours with single and turret type grinding spindles.



Columbus Chapter members (upper left) inspect manufacturer's products during a recent visit to the Denison Engineering Company. In upper right photo, First Vice-Chairman W. E. Bock is addressing the group. Several ASTE'ers (lower left) inspect a setup on the jig borer, while a special fixture on a radial drill, for boring to extremely close tolerances six stations of an indexing device, holds the interest of the engineers shown at lower right

Search for New Incandescent Lamp Filament Implemented Atomic Bomb

Pittsburgh, Pa. — An unsuccessful attempt to use uranium for an improved incandescent lamp filament paved the way for the atomic bomb, C. A. Scarlott, Manager of Engineering Publications and Editor, *Westinghouse Engineer*, Westinghouse Electric Corporation, revealed to Pittsburgh Chapter during his address, "Engineering for Tomorrow," before their January 4 meeting in Fort Pitt Hotel.

At the close of World War I, Mr. Scarlott related, Dr. Rentschler of the Westinghouse Research Department considered the strange metal, whose properties were then unknown, in his search for a better lamp filament.

Refined Uranium

With no pure uranium available for their experiments, Dr. Rentschler and his assistant, Dr. Marden, set out to make some. Within a few months, Dr. Marden had produced a pellet of uranium—small, but adequate for their purpose.

"That it was worthless as a lamp-filament material," the speaker recalled, "soon became evident. Uranium seemed to have no useful future. It appeared destined to be only a scientific curiosity, but fortunately a few scientists were interested in the metal and, hearing of Dr. Rentschler's small laboratory plant, requested small amounts aggregating a few dozen ounces over the next fifteen years."

But early in 1939, according to Mr. Scarlott, a group of American physicists informed the nation's highest military officials that it might be possible to harness the atom in a bomb so powerful as to make all other bombs but firecrackers. The Germans, they pointed out, might already be well on the way to achieving it.

Resources Provided

"Money was made available without stint," Mr. Scarlott stated. "Scientists began to congregate in new and secretly-built laboratories. Manufacturers received orders for materials and machinery for undisclosed purposes. For the greatest scientific gamble in all history, everything was at hand—except one thing. There was no uranium. . . . All that had been made in the United States, and possibly in the world, could easily be put into a small candy box. But . . . we had made a few ounces of the precious stuff and that represented the scientific know-how to make more."

Thus it came about that one day in 1940 Dr. Rentschler received a telephone call from Dr. Compton of Massachusetts Institute of Technology in Boston, explaining the urgent need for three tons of uranium! Within a few days, production at Dr. Rentschler's laboratory had reached a pound a day. A year later, the plant was turning out 500 pounds daily.

Flown to Laboratories

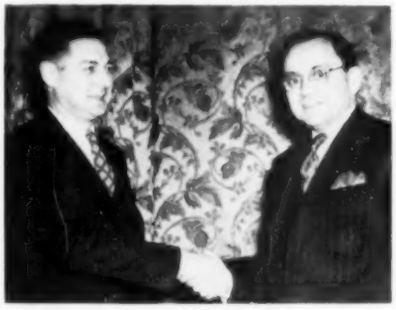
"As fast as the uranium was produced," Mr. Scarlott continued, "it was flown to waiting laboratories, particularly the Metallurgical Laboratory at the University of Chicago where the first atomic-power generator was being prepared as fast as the needed uranium could be accumulated.

"By December 2, 1943, the pile contained about 12,000 pounds of pure uranium, of which all but a few hundred pounds had come from Dr. Rentschler's laboratory plant.

"The pile was completed. The scientists, almost breathlessly, slowly withdrew the barriers or moderators from the mass of uranium. According to their calculations, at a certain point the uranium atoms would begin to destroy themselves.

Breath-taking Experiment

"They watched the instruments anxiously. Slowly the needles began to move away from the pins. For better or for worse, the first atomic-power generator in the world was at work. The greatest blue-chip gamble in history was an assured success—weeks, perhaps months, ahead of schedule because of the curiosity of scientists in a lamp-research laboratory."



Pittsburgh Chapter Chairman C. E. J. Brickner (left) thanks C. A. Scarlott, of Westinghouse Electric Corporation, for his splendid address, "Engineering for Tomorrow," given before the Chapter's January 4 meeting.

This scientific drama the speaker reviewed as an example of the constant changes in our sense of values. "Uranium, essentially valueless ten years ago," he asserted, "has become the most precious material in the world. In comparison all the gold at Fort Knox is insignificant.

"It is indicative that set notions in any field, particularly science and engineering, are always subject to rapid changes. Atomic power, while it is by far the most spectacular, is only significant of what is going on to a slower degree in other engineering fields.

Atomic Developments Uncertain

"An attempt to set atomic power in its proper place in the future engineering world," Mr. Scarlott maintained, "is about as difficult as a prophecy of the future of the steam engine when Watt first showed his crude machine. Only more so. The steam engine was allowed to follow a natural course as dictated by engineering and economics.

"But, superimposed on the technical developments of atomic power will be political and military controls, the extent and effect of which are still undetermined. In appraising the technical and economic possibilities of atomic power, however, a few facts stand out clearly:

"1—Atomic power is an actuality. From the atomic-energy piles at Hanford, Washington, several hundred thousand kilowatts of thermal power are continuously being produced as a by-product of plutonium manufacture. The heat is dissipated in the Columbia River and is enough to raise sensibly the temperature of the river.

"2—The cost of that by-product energy, if known, has not been made public. It would seem, however, that it must be high, possibly many times that of other fuels. The costs of preparing sufficient pure uranium for practical piles is likely quite high.

"Furthermore, complete 'burning' of a prepared lump of uranium is not possible. Nuclear processes produce substances that retard the reaction. In a relatively short time, the 'poisoning' reaches a degree that a complete refining operation must be performed or the uranium discarded, either of which is costly.

Small Generators Impractical

"3—Controllable atomic-energy generators of small size and weight could be built now. However, as the size of the generator comes down the richness of the fissionable material must be increased. Costs rise astronomically with degree of enrichment.

"4—The fission products are radioactive, declining to half strength in from seconds to years. These radioactive products are extremely hazardous to any form of life. Protective measures require large masses of appropriate both light- and heavy-density materials. The bulk and weight for small power plants would far exceed that of the pile itself.

"5—Fission is now accomplished with uranium isotopes or plutonium made from uranium. The amount of uranium ore and its distribution over the earth, if known, has not been made public. It is, however, definitely limited.

Other Elements Radioactive

"6—Nuclear reactions to achieve energy release with elements other than uranium are theoretically possible and may be of practical accomplishment, although no announcement of such has been made. Thorium is one possibility. Also it should be remembered that heat is available either by fission of heavy atoms into elements near the middle of the atomic scale, or by synthesis of light-weight elements into heavier ones.

"Heat from the sun is thought to be energy released as hydrogen atoms are combined into helium ones through a series of nuclear reactions.

"7—Atomic structure changes almost assuredly will become a practical power source, competition in some fields to present chemical fuels. The apparent, most likely application is ship propulsion. Large power plants using atomic fuel seem more distant, while small-size power plants for private vehicles appear quite remote.

Economy Controlling Factor

"Above all—aside from governmental controls—the laws of economics will apply. Inasmuch as fuel costs are only a portion, sometimes quite small, of the total power-production cost, investment costs may be the deciding factor. If the equipment costs for an atomic power plant were high, the plant might not be able to justify itself even if the atomic-reaction material cost nothing.

"These practical difficulties, large though they be, should not obscure the fact that atomic energy presents to the technical man enormous, fascinating opportunities and to the average citizen the greatest force of all time, for good or evil as he sees fit to use it."

In discussing the possibilities of gas turbines and jet propulsion, Mr. Scarlott

remarked that, on the day following Pearl Harbor, the Navy was consulting top-ranking turbine engineers concerning the development of a new type of engine to drive a propellerless fighter plane at speeds of more than 500 mph.

Design to Be Original

The design was to be entirely new—uninfluenced by existing jet-propulsion plants built in Europe.

Until last November, he added, when two new jet propulsion engines were shown to the press, the product of the labors of these engineers was carefully guarded.

"The significant features of these engines," Mr. Scarlott explained, "are their obvious simplicity, complete absence of reciprocating parts, and even in comparison with other jet-propulsion units, exceptionally small diameter. The 19-inch engine weighs but 780 pounds, yet delivers at takeoff 1365 pounds thrust and at 400 mph (sea level) 1200 pounds thrust. It runs at 18,000 rpm. (Jet propulsion turbines are rated in terms of thrust because to get horsepower, speed must also be considered. One pound thrust at 375 mph equals one horsepower.)

Efficiency 50% Greater

At 400 mph, performance efficiency of the 19" unit is about 50% over the best reciprocating engine, he indicated. Another advantage is that the gas turbine engine apparently has no size limitations.

Newer, undisclosed jet-propulsion engines in several sizes are now in production for the Navy, with an experimental engine for a geared-propeller drive now on the drawing boards, the speaker pointed out. The two new types of aviation drives both utilize the gas turbine—jet propulsion for extremely fast planes, and the geared-propeller for medium-speed large aircraft.

Locomotives and ships offer other applications of the gas turbine, Mr. Scarlott announced. A geared-turbine locomotive in service for over a year has, in 40,000 miles of travel, developed no major trouble with either the 6500 hp turbine or the reduction gears, requiring a trip to the shop.

Rear-engined Locomotives

Newer turbine-electric locomotives, now under way, will present a novel appearance with the coal compartment and cab at the front and the power plant and stack in the rear.

Peacetime uses of radar, Mr. Scarlott observed, will facilitate ship movements during foggy weather and enable planes to avoid unseen mountains or other planes.

One of radar's important contributions has been in the advancement of television, he declared. Extension of television broadcasting, limited to horizon distances, faced huge financial obstacles. A coast to coast hookup would require an investment of hundreds of millions of dollars in either a chain of more than 100 relay stations or a transcontinental coaxial cable.

The solution to this problem occurred to a 27-year-old electronics engineer who reasoned that an antenna could be placed in an airplane cruising 30,000 feet above the earth, thus increasing the broadcasting range. Less absorption of power by surrounding objects and a tremendous reduction in station and apparatus investment make "Stratovision" financially feasible.

In touching on new engineering materials, Mr. Scarlott referred to the high temperature alloys—K-42-B and Refractaloy—around which high-temperature gas turbines can be built.

Molybdenum, he said, has become a fascinating new material with the removal of limitations in size and shape of "moly" produced in "chunks." Conversely, its cost has been reduced two-thirds.

New Uses Found

Its excellent properties and adaptability to high-temperature applications will make molybdenum useful as crucibles, electronic tube filaments, welding alloys, and high-temperature engine parts. Each newly-discovered material, the speaker remarked, helps replace depleted stores of natural resources.

"These accomplishments of science and engineering give in this era, otherwise fraught with indecision and discord, a solid foundation on which man can build a better world," Mr. Scarlott summarized.

At the conclusion of Mr. Scarlott's address, Frank R. Foltz, Assistant Sales Promotion Manager for Westinghouse, screened an informative colored film.

Entertainment was provided by the Westinghouse Quartet. Approximately 100 members and guests attended the "Westinghouse Night" dinner meeting.

Ehrhardt and Kessler Promoted at Spicer

Toledo, Ohio — Two members of Toledo Chapter were recently promoted by Spicer Manufacturing Corporation, according to an announcement by R. B. Haynes, Manager of the Mechanical Division.

August Ehrhardt

August Ehrhardt, Past Chairman of the ASTE Chapter, has been named Master Mechanic for the Spicer company. Mr. Ehrhardt has been identified with the tool industry since 1914. He was associated with the Kent Owens Machine Company and the Morris Packaging Equipment Company before joining Spicer as a tool maker in 1935. Since then he has advanced successively to Processing, Chief Process Engineer, Chief Tool Supervisor, and Assistant Master Mechanic.

V. G. Kessler

Val G. Kessler, First Vice - Chairman of Toledo Chapter, becomes Assistant Master Mechanic. Mr. Kessler began his mechanical career in Cincinnati 37 years ago at the American Tool Works. He joined the Spicer organization in 1928 as a tool maker, later being promoted to Foreman of the Tool Room, then to Assistant Tool Supervisor, and, in January of 1945, to Chief Tool Supervisor. Both men have been active in the work of the Society.

Uecker Named Officer At Carbide Die & Mold

Pittsburgh, Pa.—William C. Uecker, formerly of Firth-Sterling Steel Company, has been made Treasurer and Sales Manager of Carbide Die & Mold Company.

W. C. Uecker

Mr. Uecker's educational background includes Penn State courses in shop engineering and also Carnegie Tech studies in commercial engineering. His 16 years carbide experience goes back to the very inception of such material at Firth-Sterling Steel Company. There since 1929 he worked in carbide shop, engineering development, and sales. After 10 years in charge of carbide-tool engineering, he became chief development engineer of the newly-formed Diecarb division.

Mr. Uecker is a member of Pittsburgh Chapter, ASTE.

Production, Competition Key to American Strength

Pontiac, Mich.—"In an effort to win public favor by giving the service that the public wants, we have become a nation of intensely competitive people. Foreigners cannot understand why we are so sincerely interested in competition. They fail to understand how it is possible for us, as competitive as we are, to group ourselves into teams and work together so effectively."

These statements formed part of an address made by Goodloe H. Rogers, President, American Forge & Socket Company, before the November 28 meeting of Pontiac Chapter.

"Mass production succeeded here," Mr. Rogers pointed out, "because the American approach was unique. The American industrial pioneers sought their customers among the masses, not among the class trades as they were known in Europe. Quantity production succeeded here because it was set up to serve the people in general; because it was considered as production by the masses and for the masses. That is the difference in the approach."

Foreign Competition

He observed that "other nations, notably prewar Japan and Germany, seemed to be threatening our position in the field of mass production of consumers' goods, but there was a significant difference in their approach to mass production and it is that difference in approach which is the basic difference between Americans and other peoples.

"It is the combination of our unique approach to the art of mass production and our love of competition that makes us strong and distinguishes us from the rest of the world," the speaker asserted.

"These two qualities enabled the automobile industry to become in a brief half century a source of national strength capable of producing one-sixth of the nation's war materials," Mr. Rogers added.

The meeting, attended by 72 members and guests, was held at the Forest Lake Country Club. Sound films were shown, and a musical program was presented.

Labor, Management Affect Future of Tool Designing

Rochester, N. Y—The impact of external forces upon the design of machine tools was emphasized by Myron S. Curtis, Consulting Engineer, The Warner & Swasey Company, Cleveland, Ohio, and technical speaker at the December 12 meeting of Rochester Chapter, held in Rochester Institute of Technology. Mr. Curtis' subject was "The Economics of Future Machine Tool Design."

Labor's attitude in its efforts to secure higher wages for less production was the first aspect discussed by Mr. Curtis.

Multi-tooling Indicated?

He cited an instance where a manufacturer was using one multi-automatic machine tool in a production line. To avert a tie-up in case of breakdown, the machine was replaced with five single spindle machines which could easily have been run by one operator. The labor forces, however, insisted on having each machine individually-manned, increasing the labor cost 500% for these operations.

Myron S. Curtis of The Warner & Swasey Company, Cleveland, tells Rochester Chapter that labor's demands for more wages for less production may influence the design of machine tools. Mr. Curtis discussed the "Economic Asoects of Future Machine Tool Design" at the Chapter's December 12 meeting.

Another factor affecting future machine tool design, the speaker pointed out, is that large corporations frequently dictate questionable practices, such as the use of footed electric motors instead of flange-type motors.

Many Factors to Consider

Other forces, which Mr. Curtis listed as influential in the design of new machine tools, include new and better cutting materials, coolant systems, chip disposal conveyors, hydraulic and electronic devices, rapidity of change-over on automatic machines, and new structural materials such as alloy ferrous and non-ferrous metals, and plastics.

The approximately 100 members and guests present thoroughly enjoyed Mr. Curtis' able presentation.

Guests introduced included Second Vice-Chairman John Allmon of Detroit Chapter, John Bartek, a former Chairman of Rochester Chapter, and Clarence Van Duser, a recently-discharged Armed Service member.

Houston ASTE'ers observed Annual Ladies Night with a semi-formal dinner dance, December 12, at the Golfcrest Country Club. Fifty-six couples attended the pleasant social function.

Magnesium Called Metal with Future

Houston, Texas—At the January 8 meeting of Houston Chapter, R. E. Bockrath of the Dow Chemical Company declared that magnesium will be an important metal in the future.

Tool Engineers, he said, would be wise to study the metal in its available forms and compositions. Mr. Bockrath's technical talk concerning magnesium was supplemented by a film entitled, "The Working of Magnesium."

Dow Warren of the Reed Roller Bit Company explained to the members the economic benefits to be derived in the future from more efficient tooling for production work.

Ninety-six members and guests attended the meeting in the Golfcrest Country Club.

* * *

Houston members played host to their ladies December 12 with a semi-formal dinner dance at the Golfcrest Country Club. The event was the Chapter's Annual Ladies Night.

Dinner was served to 112 at attractively decorated tables in the spacious Club dining room. Each lady received a corsage.

One of Houston's most popular dance orchestras furnished music for dancing in the ballroom. Popular dance of the evening was the "Paul Jones" in which most of the group participated.

Arrangements for the enjoyable affair were handled by James Fowler, Chairman of the Entertainment Committee.

750 Visit Kaiser Plant

Los Angeles, Calif.—Members of Los Angeles Chapter enjoyed a tour of the Kaiser Steel plant at Fontana, for their November meeting. Because of the large number wishing to participate, the Chapter was divided into two groups.

On November 2 approximately 300 visited the plant which is nearly 50 miles from Los Angeles. A second group of 446 made the trip on the 9th. Dinner was served in the cafeteria before the members were escorted through the mills, in small parties. Because of the distances between the various buildings, the visitors rode in their automobiles, with about 20 cars to each party.

The ASTE'ers saw the operation and tapping of the blast furnace; drove around to the coke ovens, then to the open hearth furnaces, and finally to the soaking pits and rolling mills. Members of the Kaiser Sales Department conducted the engineers on this exceedingly interesting tour.

Heat Treating Known To American Indians

Fond du Lac, Wis.—A heat treating process, similar to that now employed for refining steels, was used by American Indians in curing birch-bark and roots to build their canoes, according to William K. Andrew, Engineering Sales Manager, Kearney & Trecker Corporation, Milwaukee, and President of the Wisconsin State Archeological Society.

Mr. Andrew made this observation during his illustrated lecture on Indian lore, given December 13 before a meeting of Fond du Lac Chapter, held in the American Legion Club at Appleton.

Human relations, too, were no different among the aborigines than in our own complicated civilization, he pointed out. Councils of friendly tribes cooperated to maintain peace among themselves and to unite their forces against hostile tribes.

Mr. Andrew urged his audience to inspect the comprehensive exhibit of Indian lore in the Milwaukee museum, one of the finest in the country. The speaker also exhibited and described a display of rare Indian artifacts.

Guests present included Ping Yuan Tse of the National Resources Committee of China.

Compares Broaches And Techniques

Milwaukee, Wis.—Technical speaker for the December 13 meeting of Milwaukee Chapter was Norman H. Iversen, Chief Engineer, Michigan Broach Company, Detroit. Mr. Iversen's topic was "Broaching Design and Production Broaching."

N. H. Iversen

The speaker detailed and compared standard types of broaches and multiple-piece broaches used in production runs where two or more pieces are machined simultaneously. He described surface broaches used for simplifying milling operations.

At the conclusion of his talk, Mr. Iversen answered questions and showed two interesting films on broaching applications.

As an added feature, a sports film, "Daredevils on Ice," was screened. The thrilling production depicted bob sleds racing down an iced runway and making turns on vertical walls.

The dinner meeting was held at Hotel Schroeder.

Induction Heating Hardens Screw Machine Bar Stock

South Bend, Ind. — Dr. Harry B. Osborn of the Ohio Crankshaft Company, Tocco Division, Cleveland, Ohio, addressed South Bend Chapter at their December meeting. Mr. Osborn's subject was "The Tocco Process of Induction Hardening." After summarizing past developments in induction heating, the speaker briefly described the electrical equipment for producing high-frequency electric current.

Dr. H. B. Osborn

The outstanding advantage of induction hardening, Dr. Osborn said, is that localized surfaces such as gear teeth and bearing locations can be surface-hardened without causing brittleness in the center of the piece.

Another superiority has been demonstrated in the production of mortar shells by brazing together three simple parts instead of forging the shell as one unit, he pointed out.

Induction heating has also been used for brazing carboloy tool bits to steel shanks. The use of this process gives a much more uniform quality than was previously obtained by hand-operated torch brazing.

Dr. Osborn stated that the high initial cost of an induction unit was more than offset by the low operating expense and the high production achieved. Through the use of induction heating, hardening is now controlled by the automatic cycling of the machine, instead of manually.

Relatively small and self-contained, induction heating units can be placed directly in the production line, thereby eliminating the necessity of carrying parts to and from a heat treating department.

Recently, the speaker related, induction heating has been introduced as a means of uniformly treating screw machine bar stock so that the parts are of a constant hardness, permitting the screw machine to be run at a higher speed.

Formerly it was the practice to have these bars treated at the steel mills, but now many companies are doing this by induction heating at a lower cost, in their own plants, he concluded.

Unbalance Detected By Modern Machine

Richmond, Ind. — "Recent Developments in Balancing Machines" were discussed by Fred R. Bokorney of the Gisholt Machine Company, Madison, Wis., technical speaker appearing December 11 before Richmond Chapter.

Mr. Bokorney discussed static and dynamic unbalance and the development of machines to detect and measure it, as well as the various methods used to correct this condition. The speaker augmented his address with slides.

Coffee speaker was Capt. Hans Belitz who became a member of the U. S. Army Air Force shortly after his naturalization. After several missions over Germany, he crashed and was imprisoned at Sagan.

Capt. Belitz related several of his experiences while a prisoner and told of his escape and journey back to the American Forces.

The meeting was attended by 53 members and guests.

Sponsors Design Courses

Toronto, Ont.—The special evening classes in tool engineering so successfully sponsored by Toronto Chapter, ASTE, are being continued this season, under the direction of John Lengbridge and Roy M. Sherk of the Education Committee.

Two courses are being offered, one in "Punch and Die Design for Pressed Metal Operations," and the other a study of "Manufacturing Processes as Applied to Design."

The former course is being conducted at the Aluminum Goods, Ltd., plant on Tuesday and Thursday evenings, with Mr. Lengbridge as instructor. Subjects include:

Cutting Operations—Theory of cutting metal in dies; types of tools used; details of design; and selection of presses.

John Lengbridge

Roy M. Sherk

Drawing Operations—Theory of drawing; metal flow; reduction percentage; types of tools used; details of design; die cushions; blank calculation; and lubrication.

Miscellaneous Pressing Operations—Expanding operations; contracting operations; and curling.

Cost of Pressing Operations — Estimating; cost analysis; and study of pressing methods.

Lectures are given from prepared notes, with sketches showing important design details available to the students. Basic data is dictated to enable students to accumulate useful notes concerning the sketches. Production samples of pressings are displayed to illustrate difficult press problems. Each evening a portion of class time is devoted to open discussion.

F. M. Schytte

Standards Chairman Fred M. Schytte is instructing the class in manufacturing processes which meets each Monday at the Central Technical School. The first semester's work covers "Hobbs and Broaches," including: Gearing and Gear Cutting; Spline Cutting; Special Shapes by the Hobbing Process; Designing Gear, Spline and Special Purpose Hobbs; and Broaching and the Design of Broaches.

The second half of the course is expected to consist of individual lectures on such topics as Milling Practice, Grinding, Foundry Technique, Patterns, and Jig and Fixture Design.

Toronto Chapter courses have proved very popular, according to Education Chairman Lengbridge who reports that last year "75 members from 30 firms registered for the design classes, 60% of them completing the course. Three of the students came all the way from Batawa without missing an evening."

Niagara District Fetes Ladies With Supper Dance

Niagara District Chapter members entertained their ladies recently with a supper dance in the Cypress Room of the Welland House, St. Catharines, Ont. The affair, attended by 120 guests who danced to the music of Murray Morton, was the Second Annual Ladies Night. A cold plate lunch was served during the evening.

Entertainment Chairman Norman Coleman organized the dance in cabaret style, giving the function a festive atmosphere. Chapter Chairman Henry Hendriks welcomed the guests, some of whom came from as far as Toronto. Photo shows a group of Chapter executives and their guests.

Elements Take Toll of Machines in Former German War Plants

RUST, NOT BOMBS, inflicted the greatest damage on many of Germany's war plants, according to John R. Morrison of Pittsburgh Chapter, ASTE, recently returned from European service with an ordnance repair unit.

"The great MAS works in Augsburg, builders of huge Diesel and gasoline engines," Mr. Morrison stated, "were not too damaged, except for the rust caused by rain coming through the roofs. So, too, the large Henschel-Sohn locomotive works, converted to wartime production of the 'Tiger' tank.

J. R. Morrison

"Many of the fine machines were not even dented," he observed, "but the exposure to the elements after the roof was knocked off caused a great deal of damage."

Among Mr. Morrison's war souvenirs is a collection of small posters promoting production and patriotic zeal, taken from the NSU factory in Stockstadt.

"This factory," Mr. Morrison continued, "specialized in the manufacture of bicycles, motorbikes, and gasoline-powered, portable tree-felling saws. Wartime items, in addition to these, included the famous German tractor-type motorcycle.

"The destruction wrought on this plant by air raids and direct firing was not too extensive nor severe. But the lack of suitable preservative materials for protecting the machinery from the elements will necessitate reworking many of these machines before manufacturing can be resumed."

During his military service, Mr. Morrison was attached to the 905th Ordnance Heavy Automotive Maintenance Company, a unit of the famous Seventh Army. "This company," he explained, "performed the highest echelon of maintenance and repairs to general purpose motor vehicles.

"Production figures averaged approximately twenty vehicles per day. Assembly line methods were employed wherever possible. A group of inspectors would write a report of the repairs required. The vehicle would then be taken to the chassis bay where the engine, transmission, transfer case, axles, and so forth would be changed as units.

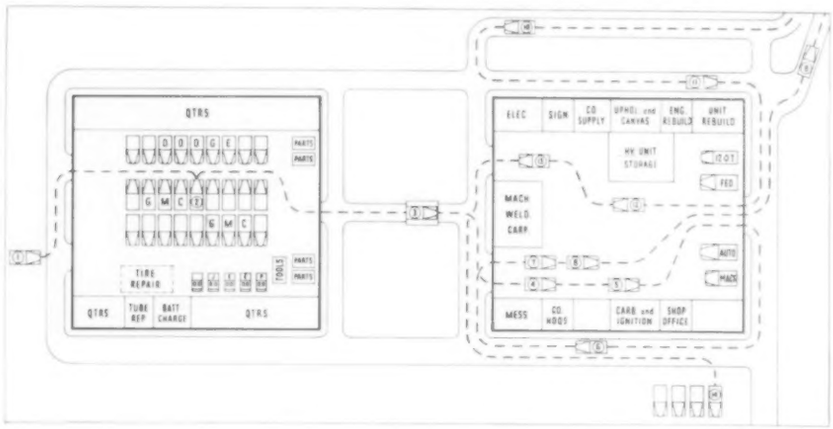
"Moving to the next department, the automotive unit was further serviced with relining and adjusting of brakes if necessary. After the engine had been tuned and timed in the carburetor and ignition department, the vehicle would be given a preliminary inspection before going on to the sheet-metal and carpenter shops for body repairs.

"Final inspection with a severe test run of perhaps ten miles, steam cleaning and painting completed the repair job. Auxiliary shops included: engine rebuild, unit rebuild, upholstery, welding, sign painting, and electrical.

"The supply problem was a formidable one, too, Mr. Morrison pointed out, as "parts had to be carried for anything from a Jeep to the large 12-ton Diesel prime movers.

"Local civilian labor was used whenever possible. At times we had as many as 350 civilians on the payroll. It seemed that no sooner were the Arab, Italian, French or German employees trained in the work, than it would be necessary to move forward with the Army and start all over again—in a new language.

"To move such an organization, complete with supplies, equipment, and vehicles, with no appreciable loss in production (moving one section and shop



No.	Operation	No. of Vehicles At Operation	Average Time for Operation
1	Preliminary Inspection	100 (Backlog)	1 Hr.
2	Chassis Bay	75	8
3	Grease	8	½
4	Brakes	3	½
5	Carb. and Ignition	6	1
6	Preliminary Inspection	3	½
7	Body Work	3	1
8	Carpenter Work	2	1
9	Final Inspection	3	1
10	Wash	1	½
11	Steam Clean	1	½
12	Dry	10	3
13	Paint	3	1
14	Awaiting Delivery	20 per Day	

905th ORD. H.A.M. Co.
TYPICAL SHOP LAYOUT
Henchelflugmoterwerk
Kassel, Germany

This drawing of a typical shop layout for the 905th Ordnance Heavy Automotive Maintenance Company shows the assembly line methods employed by the Army. Installation diagrammed was at Henchelflugmoterwerk, an aircraft engine plant in Kassel, Germany. The Ordnance repair unit, of which ASTE'er John R. Morrison was a member, followed the advance of the Seventh Army through Europe.

One of the tractor-type motorcycles used by the Germans in mopping-up operations through country laid waste by their armies. Scene shown is a street in a Ukrainian village. This illustration was reproduced from the cover of a German technical paper, one of John R. Morrison's war souvenirs of the European theater.

Here are several of the interesting German technical papers which ASTE'er John R. Morrison collected during his Army service. Die Oganische Betriebsgestaltung is a management publication, while Werkstattstechnik Der Betrieb (Shop Technique) is a mechanical trade paper. The August, 1944, cover of Der Erfahrungsaustausch, an ordnance journal, shows the launching of a "V1" rocket bomb, "the first German revenge weapon." The copy of Patentblatt describes, under the Nazi swastika, recent patents.

at a time) called for complete teamwork and control. Actual moving time was usually three to four days, if the move were not over a hundred miles."

In addition to the war plant posters, ASTE'er Morrison brought back a file of the German ordnance journal, *Der Erfahrungsaustausch*, and copies of the technical magazine, *Werkstattstechnik Der Betrieb*, as well as the publications, *Die Organische Betriebsgestaltung*, and *Patentblatt*.

"Now that I am back to civilian life again after more than four years in the Army," Mr. Morrison concluded, "I have resumed my duties in the Engineering Department of the Pittsburgh Tube Company, manufacturers of pipe, cold drawn tubing and related specialties. I again find THE TOOL ENGINEER pleasant and profitable reading, and I'm looking forward to the interesting meetings of the Pittsburgh ASTE Chapter."

Spark Testing of Steels Cuts Cost, Baxter Says

Boston, Mass.—Great savings are possible through spark testing in the examination and sorting of questionable steels, according to James V. Baxter, Chief Inspector at the United Shoe Machinery Company, Beverly, and technical speaker at Boston Chapter's December 13 meeting.

Mr. Baxter, in his lecture, "Spark Identification of Steel," demonstrated samples of straight carbon steel, from 1020 with the long carrier lines to high carbon with the short spark stream and plentiful spark burst. The higher the carbon, the more plentiful the burst, he said, because carbon in contact with air creates a pressure which causes the globules to explode, accounting for the pine tree effect in high carbon sparking.

Manganese Brightens Spark

A small percentage of manganese, the speaker explained, tends to brighten the spark and increase the spray around the periphery of the wheel, while silicon causes a fuzz close to the wheel.

Chromium suppresses the spark stream and the burst, darkens the color and causes fine carrier lines. Nickel content also has a tendency to subdue the spark stream and burst. Samples of high carbon, high chrome steel were compared to straight high carbon tool steel.

Molybdenum, Mr. Baxter identified by the characteristic, detached spear-head at the end of the rays.

Fine red carrier lines, along with a reduced spark stream and burst, are indications of the presence of tungsten, he commented. High tungsten steel tests with a complete absence of burst, tungsten being the most potent alloy in changing the color of the spark.

Knowledge of Steel Vital

Mr. Baxter emphasized the importance of knowing the exact nature of the high speed steel being heat treated, because of the critical temperature and other characteristics of each type.

He demonstrated the variation in sparks of high tungsten 18-4-1, molybdenum (only about 1½% tungsten and 9% moly) which is critical because of a tendency to decarburize; the 14% tungsten-4% chrome, and the 6-6-2 type, containing about 6% moly and tungsten and 2% vanadium.

In another test, Mr. Baxter showed how a decarburized surface on a finished cutting tool can be detected by comparing the spark with a spark on another surface of the tool, on which the decarburization has been ground away.

These tests, as conducted by the speaker, were enlightening and conclusive.

"Hard Materials and How to Use Them" was discussed by Wilfred Wells, Vice-President, Waltham Precision Tool Company.

Mr. Wells gave comparative hardness readings and tensile specifications of tungsten carbide, boron carbide, sapphires and diamonds. With slides, he showed many applications of these hard materials, such as in plug gages, dies, burnishing tools and wear-resisting plates. Comparative figures on abrasion and corrosion tests showed many superiorities for tungsten carbide over chrome plating or nitriding.

Shows Uses of Boron Carbide

Applications and advantages of boron carbide, or Norbide, an exclusive product of Norton Company, were also demonstrated by Mr. Wells. Slides illustrated the processing of Norbide in the electric furnace. On pressure blast nozzles, 100 times more life is claimed for this material.

The speaker also described natural and synthetic sapphires, showing applications of burnishing and grinding with sapphire wheels. Sapphire indicator points, he recommended for long wear. An outline of the uses of diamonds and diamond wheels concluded his remarks.

These posters were displayed in the NSU plant at Stockstadt, Germany, where the German tractor-type motorcycle was produced. Poster at the left reads: "Boss Tueftele discerned a mind which was not focused on the job. Naturally, an employee is permitted to think of other things while his hands continue to produce. One thing is important, though: if one wants to make improvement suggestions and advance in the NSU, he must keep his wits about him. In this way, new ideas can be developed, says Boss Tueftele."
"Boss Tueftele" (Mr. Punctilious) is an imaginary character hovering over the NSU employees, personifying efficiency. A delicate double entendre is conveyed in the drawing of the decapitated figure.
The propaganda at the right states: "Because, many thousands of years ago, England was connected with the continent, even today herrings swim around the island instead of going through the channel. But, we are not herrings. We reason, like crafty people, how to reach the objective in the easiest and quickest way. Make your suggestion. Every good tip will be rewarded."
Both posters conclude with the slogan: "You, too, should help NSU!" Part of a series acquired overseas by John R. Morrison of Pittsburgh, they were produced on paper bearing other printing on the reverse side, apparently in the interests of conservation.

Notice to ASTE Members

Difficulty in securing delivery of 1946 Membership Cards has delayed National Headquarters in issuing them to members. When the cards are received from the printer, they will be mailed in acknowledgment of the current year's dues.

Coming Meetings

ALL CHAPTERS—March. Installation of Officers.

DAYTON—Plant Visitation, March 11. Dinner 6:30 P.M., Manchester Hotel, Middletown. Tour of Armco East Works, American Rolling Mill Co.

ELMIRA—March 4, Mark Twain Hotel. Speaker: Prof. Lee DeWald, Massachusetts Institute of Technology, Cambridge, Mass. Subject: "Cemented Carbides."

HARTFORD—March 4, 8:00 P.M., Hartford Gas Co. Speaker: Erik Oberg, Editor, *Machinery*. Subject: "Voluntary Economic Systems vs. Compulsory Economic Systems."

NEW HAVEN—March 14. Dinner, 6:30 P.M. Technical Session, 8:00 P.M., Chi Psi House. Speaker: C. J. Linxweiler, Manager, Machine Tool Distribution, Sheffield Corp., Dayton, Ohio. Subject: "Crush Dressing of Grinding Wheels."

NEW ORLEANS—March 12. Film: "Electron at Work," presented by Westinghouse Electric Corp., E. Pittsburgh, Penna.

ROCHESTER—Annual Membership Meeting, February 20, 8:00 P.M., Victoria Room, Hotel Sheraton. Films, refreshments. Admittance by membership card only. Annual Ladies Night Dinner Dance, March 2, Powers Hotel.

TOLEDO—Annual Ladies Night, February 16, Toledo Yacht Club. Dinner dance, entertainment, door prizes, corsages for ladies. Business Meeting, February 27, Toledo Yacht Club.

TORONTO—Annual Ladies Night, March 15. St. Patrick's Dinner Dance, Royal York Hotel Concert Hall. Music by Stanley St. John and his orchestra.

Methods Engineering Aid to Competition

Elmira, N. Y.—Methods Engineering, while lightly regarded by some industries, is the scientific program for meeting competition through lower costs, by reducing labor complaints through employee satisfaction and by effective management, John L. Schwab, Chief Industrial Engineer, Bryant Electric Company, Bridgeport, Conn., declared in an address on this subject, given before the January 7 meeting of Elmira Chapter.

Many industries, Mr. Schwab continued, will survive through Methods Engineering; others will fail because they ignore these fundamental laws of management.

Presentation Convincing

The speaker's dynamic and energetic manner was accented with a contagious enthusiasm as he reviewed the history of Methods Engineering from its beginnings with earliest man, through the contributions of Taylor, Gilbreth and others.

Defining this branch of engineering, he emphasized that its functions are interwoven with the work of the Tool Engineer.

Mr. Schwab further stressed that Methods Engineering is an exact science, furnishing a direct plan for management when the proven laws are applied. Application, he pointed out, must be handled by trained and experienced personnel to avoid constant revision of programs.

Slides were shown for illustration, as the speaker concluded with a preview of a new point system of evaluation to simplify cost estimates of direct labor.

Collaborates on New Book

A complete description of the system will be included in a new book, "Methods and Time Determination," of which Mr. Schwab is co-author. He is well-known for his earlier books and trade paper articles on Methods Engineering.

President and National Director of Bridgeport Chapter, The Society for the Advancement of Management, Mr. Schwab is also National Vice-President of the Industrial Methods Society and a member of the faculty of New Haven Junior College and of Bridgeport Engineering Institute.

The showing of "AT-21," a sound film in technicolor, concluded the meeting. The production, depicting the Attack Trainer Plane produced by Fairchild Aviation Corporation, was highlighted with detailed views of the fabrication of laminated plywood forms.

Urges Care in Selecting Proper Carbide Tools

Racine, Wis.—December meeting of Racine Chapter was held at the Manufacturers Association Building on the 3rd, with about 85 members and guests present.

N. E. Carpenter of Firth-Sterling Steel Company showed a sound film, "Firthite Carbide Tooling." Mr. Carpenter answered questions pertaining to the application of carbide tools to specific materials and work, stressing selection of the correct grade of carbide tools for the job to be machined.

A display exhibited by Boyar-Schultz Corporation of Chicago and Economy Tool Company proved interesting to the group.

Elmira Chapter found "Methods Engineering" a stimulating subject, as presented by John L. Schwab of Bryant Electric Company, speaker at their January 7 meeting. With him at the table are, left to right, Secretary Floyd B. Allen, (Mr. Schwab), Chairman George N. Morceau, Second Vice-Chairman Edward Stachel, and Treasurer James F. Deegan.

Program Personalities

"Heat Treating of Metals in the Salt Bath" is the topic presented by A. F. HOLDEN, President, and DR. HAIG SOLAKIAN, Vice-President, The A. F. Holden Co., New Haven, Conn.

A. F. Holden

Mr. Holden develops his talk on the phase of the subject which is of especial interest to the group being addressed.

Subjects pertinent to tool engineering include the hardening and secondary treatment of high speed tools, the heat treating and quenching of tool steels by direct quenching or control quenching, and the heat treating of production steels by standard quenching methods or by isothermal or martempering methods.

Mr. Holden's long experience in metallurgy has been devoted primarily to the development of products for the metal working field, in collaboration with his engineering staff. His company specializes in heat treating salt baths and related equipment.

Dr. Solakian's lecture embraces: 1—review of salt baths; 2—their physical and chemical properties; 3 — their advantages and limitations; 4 — suitable furnace equipment to utilize salt baths; 5—proper technique in operating salt baths; and 6 — precautions to avoid trouble.

Dr. Haig Solakian

He has held important posts largely as Research Metallurgist or Chief Metallurgist with Bethlehem Steel Co., The Pyrites Co., Remington Typewriter Co., U. S. Smelting and Refining Co., U. S. National Bureau of Standards, and Geometric Tool Co. His Doctor of Science degree and contributing degrees were granted by Massachusetts Institute of Technology.

A member of New Haven Chapter, ASTE, he is also affiliated with ASM and Technology County Club.

Either speaker is available to any Chapter of the Society, and may be addressed directly at the Holden Company.

* * *

J. B. JILBERT, Chief Industrial Engineer, Ampco Metal, Inc., Milwaukee, Wis., and Second Vice-Chairman, Milwaukee Chapter, ASTE, is available to most ASTE Chapters as a speaker on the "Machining of Ampco Metal." He is also the author of a booklet on this subject.

J. B. Jilbert

Mr. Jilbert became associated with the Ampco organization in 1940 as Ass't Superintendent of the Machine Division. Two years later he laid out and supervised the purchase and installation of all equipment for the Ampco Defense Plant Building.

A University of Illinois graduate in Industrial Engineering, he served an apprenticeship with the Barber-Colman Co., Rockford, Ill.

In discussing his subject, Mr. Jilbert makes specific recommendations on the proper machining of Ampco aluminum bronzes and other copper-base alloys, stressing the necessity of following these procedures for good results in processing non-ferrous metals.

His remarks are illustrated with a 30-minute, 16mm. color-sound film and a slide film.

Mr. Jilbert can accept invitations from all ASTE Chapters, except those in Canada, the far South, northern New England, and on the West Coast. Requests to hear his lecture should be addressed to R. J. Thompson, General Sales Manager, Ampco Metal, Inc., 1745 S. 38th St., Milwaukee 4, Wis.

FILM FLASHES

Swaging—The fast, precise, no-scrap, forming operation, which played such a prominent part in the establishment of wartime production records, is depicted in a new film now available throughout the world.

A sound commentary has been prepared in English, French, Russian and Spanish. The 26-minute production gives a popular Hollywood-style portrayal of the many applications of the swaging process in today's mass production methods for pointing, shaping, and attaching fittings to bar, cable and tube.

Steel — including stainless — copper, aluminum, and even wood products are shown to be within the scope of the swaging process.

Names of local depositories of the 16mm. sound film may be secured from Standard Machinery Co., Providence 7, R. I.

* * *

Carbon—Black Treasure—Reveals the processing and production of carbon and graphite electrodes, and graphite anodes.

It is a colorful synopsis of the many operations required to build into carbon and graphite the electrical conductivity and mechanical strength which make possible electric furnace operation and the production of steel.

Included in the sequences are the selection of raw materials, calcination, extrusion, baking, graphitization and finishing.

Kodachrome, 16mm. sound film. Running time, 37 minutes. Available from National Carbon Co., Inc., Niagara Falls, N. Y.

* * *

Golden Horizons—A fascinating story of the basic metals through the ages.

Opening in an historical setting of 7000 B.C., the theme unfolds with the development of civilization and the discovery, uses and working of metals.

In the second half of the film, these crude methods of processing non-ferrous metals are contrasted with present day electric furnace operation and procedures in modern plants.

Photographed in technicolor, the 16-mm. sound film runs for 33 minutes.

Requests to borrow the film should be addressed to Ampco Metal, Inc., 1745 S. 38th St., Milwaukee, Wis.

* * *

Carbide Steel Milling—A summation of experience in the application of steel cutting grades of carbide. Nine of the chief characteristics of carbide steel milling, with operational illustrations and case histories, are described in the production.

If desired a lecturer will be furnished to address technical groups, in connection with the screening of the film.

The 35-minute, color-sound presentation may be borrowed from Kearney & Trecker Corp., Milwaukee 14, Wis.

* * *

An American Miracle—Combining on-the-spot photography with pictorial animation, this film graphically illustrates how a typical job is actually set up and operated on a "balanced" mass production basis.

Using a simple little 3-inch shot as an illustration, this picture visualizes the intensive planning, engineering and machinery necessary to achieve a balanced production line on an item which, compared to trucks or locomotives, seems relatively small and easy to produce.

Basic steps involved in setting up balanced production for the 3-inch shot are vividly illustrated in animated sequences showing complete production and assembly lines in operation. Everything is arranged so all the parts flow smoothly from production to final assembly in a seemingly endless procession.

Running time for the 16mm. sound film is 18 minutes. It may be secured from the Department of Public Relations, General Motors Corporation, 1775 Broadway, New York 19, N. Y.

Several members of Greater New York Chapter cluster around Chairman J. D. Schiller, after December 17 meeting, to see engineering data presented by one of the technical speakers. The group includes (left to right) Education Chairman Carl Kertesz, Membership Chairman Eugene Roth, Treasurer E. J. Novak, Finance Chairman Joseph Brady, Constitution and By-Laws Chairman A. A. Peeters, Mr. Schiller, First Vice-Chairman Holbrook Horton, Editorial Chairman W. A. Zieve, Second Vice-Chairman H. S. Hunt, Past Chairman J. J. Hogan and Entertainment and Program Chairman Julius Schoen. Below are some of the 250 members present for the technical session held in the Hotel New Yorker.

Speakers Collaborate On "Crush Dressing"

New York City—A joint presentation on "Crush Dressing" by Carl Linxweiler, Manager of Machine Tool Distribution, and R. Y. Moss, Production Engineering Manager, Sheffield Corporation, Dayton, Ohio, featured the December 17 dinner meeting of Greater New York Chapter.

In their slide-illustrated discussion, Messrs. Linxweiler and Moss thoroughly explained the crush dressing of grinding wheels and the application of multiform wheels for reproducing intricate forms accurately, quickly and economically.

C. J. Linxweiler

R. Y. Moss

Another speaker, Charles F. Myers, New York Representative, Republic Drill & Tool Company, Chicago, Ill., described "Shankless Drills" and their applications, illustrating his remarks with several excellent films. These, he supplemented with a display of drills. Of particular interest in this exhibit was a special oil-fed type for deep-hole drilling.

Capt. Timothy Healy of the U. S. Treasury Department spoke briefly, expressing recognition of the part played in the war effort by Tool Engineers. He also thanked the Chapter, on behalf of the Treasury Department, for their cooperation during the Victory Bond campaign.

At the close of the meeting, refreshments were served to the more than 250 members present.

Explains Advanced Milling

Hartford, Conn.—The January meeting of Hartford Chapter was held on the 7th, with dinner at the City Club, followed by a technical session in the Hartford Gas Company Auditorium.

Speaker of the evening was Z. C. Van Schwartz, Chief of Machinery Development and Research at Peck, Stow and Wilcox Company, Southington, Conn. His topic concerned "High Speed and High Cycle Milling Through the War's Tool Emergency." This subject was fully discussed by the speaker who offered further to answer, by correspondence, questions relating to his topic.

About 70 members and guests attended the dinner, with 125 present for the technical session.

* * *

The December 3 dinner meeting, held at the Hartford Trade School, was designated "Father and Son Night."

Alonzo Grace, Commissioner of Education for the State of Connecticut, gave the principal address. His subject, "The Development of Technical and Vocational Education in Connecticut," was well covered and enjoyed by the audience.

O. W. Winter, National Education Chairman, ASTE, spoke interestingly on "Educating Future Tool Engineers."

Obituaries—

Henry J. Jamieson

Henry J. Jamieson, 60, Assistant Manager of the Tool Engineering Department, International Business Machines Corporation, Plant No. 1, Endicott, N. Y., and a charter member of Binghamton Chapter, ASTE, died recently at the Robert Packer Hospital, Sayre, Pennsylvania, after a brief illness.

H. J. Jamieson

Mr. Jamieson was born in Angola, N. Y., and had his early schooling in Buffalo. He was employed at the Willys-Morrow plant in Elmira for 14 years. After two years at Morse Products, Ithaca, he joined International Business Machines as a member of the Tool Inspection Department. In December of 1941, he was promoted to Machine Room Supervisor and in May, 1943, he assumed the duties he was discharging at the time of his death.

Through home study, he completed two four-year courses—one in Factory Management offered by the Willys-Morrow Company, and an I.B.M. course in Manufacturing and Tool Analysis.

In addition to taking an active interest in ASTE, Mr. Jamieson was a member of Jesse L. Cooley Lodge, F. & A. M. 966, Elmira.

* * *

John W. Baker

Victim of a tragedy while en route from the recently concluded European hostilities to the United States where he was to be trained for Pacific duty, Sgt. John W. Baker of Northern New Jersey Chapter, ASTE, was lost at sea July 5.

J. W. Baker

Sgt. Baker, Radio Operator on a B-17 Bomber with the 8th Air Force in England, had participated in a raid over lower Germany and Czechoslovakia in April. After the surrender of Germany, he was deployed to the United States for further training before being assigned to service in the rapidly-terminating Japanese war.

On July 5 his plane developed engine trouble in the last lap of its homeward flight, after leaving the Azores, and crashed into the Atlantic. Several of the crew, including Sgt. Baker, managed to clear the wreckage before it sank. Having no life-saving equipment other than his life-belt, Sgt. Baker succumbed to the cold and choppy water soon after dawn. Later in the day, the surviving crew members were rescued.

A special service in his memory was recently held at the Madison Avenue Christian Reformed Church, Paterson, New Jersey, of which Sgt. Baker was a member.

Mr. Baker was born in Paterson and graduated from Eastside High School and Newark College of Engineering. Before entering the service in August of 1943, he was employed as a Tool Designer at Acme Tool and Machine Company in Kearny.

* * *

Harry W. Cowan, Sr.

Harry W. Cowan, Sr., Sales Manager of the Machine Tool Division, The Chas. A. Strelinger Company, Detroit, for the past 28 years, died November 5 after a short illness.

H. W. Cowan, Sr.

Mr. Cowan was born in Port Huron, Michigan, in 1891, and was educated in the schools of that community. He served an apprenticeship as machinist in the Grand Trunk Railroad Shops there, and later learned saw-making, advancing to the position of Superintendent of the Wilson Saw & Mfg. Company. During this period, he served for two years in the National Guard at Port Huron.

In 1912, he joined the Strelinger organization as a machine tool salesman and, within five years, became Sales Manager of the Machine Tool Division.

During both World Wars, he worked very closely with the government and Michigan war plants, in connection with their machine tool requirements. In the recent World War, he was an active member of the Machine Tool Panel of the Detroit Ordnance District.

An early member of Detroit Chapter, ASTE, Mr. Cowan was one of the original members of the "ASTE Hounds," a social club organized on the spur of the moment during the ASTE convention at Pittsburgh. He was also affiliated with the Detroit Yacht Club and the Detroit Board of Commerce.

Armed Service Members

(Now or formerly)

Read, on Page 58, John R. Morrison's observations on his European war service; and, on Page 63, of Erwin J. Krause's miraculous escape from death while rescuing his wounded Sergeant during a jungle skirmish.

Then, tell us about your interesting war experiences. Photos and other material submitted will be returned if requested. Write to: ASTE News Editor, The Tool Engineer, 550 W. Lafayette, Detroit 26, Mich.

Arc Welding of Fixtures Economical, Conley Says

Chicago, Ill.—"Arc Welding of Jigs and Fixtures," as presented by William J. Conley, Consulting Engineer, Lincoln Electric Company, Cleveland, Ohio, featured the December 3 program of Chicago Chapter.

Before beginning his lecture, Mr. Conley presented a technicolor film, "Arc Welding—The Magic Wand of Industry." The pictures revealed that the importance of arc welding was not recognized until 1918. At that time the Navy was using arc welding to recondition ships, while the Army employed it on maintenance of equipment.

Progress after the war was slow, but gradually fabricated parts took the place of castings. Electric welding replaced riveted joints because results were quicker, lighter and stronger.

The automobile industry was the first to use electric welding extensively. It was next introduced in the building of locomotives and aircraft, reducing their weight and giving them greater strength. Structural work on buildings is now being arc welded instead of riveted.

World War II brought arc welding into greater prominence. Aircraft, tanks, vehicles, ships, buildings and petroleum pipelines were arc welded to save time, weight and materials, the film revealed.

Mr. Conley explained and illustrated with blackboard sketches how arc welding saves time in making fixtures. Castings for large fixtures, he pointed out, involve considerable time and labor in making patterns and pouring the metal, as contrasted with the fabrication of metal plate into fixtures.

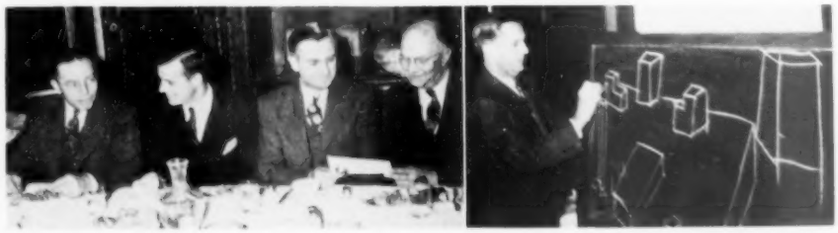
The speaker concluded his discussion by showing how various types of fixtures can be designed and made by the latter method.

Ladies Attend Holiday Party

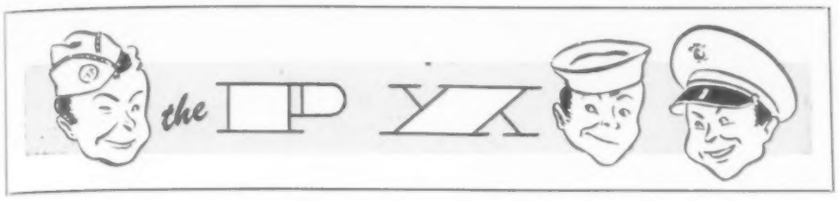
Dayton, Ohio—One hundred and fifty members, their wives and guests attended Dayton Chapter's Annual Christmas Party held in the main ballroom of the Van Cleve Hotel, December 14.

Entertainment consisted of dinner music, and several acts featuring such headliners as Kan-Du, the Clown Prince of Magic; Ruth Gossett, "Tops in Taps"; and Virginia King, National Baton Twirling Champion.

Dancing was enjoyed from nine to one to the strains of Chris Eichner's band.



Seated at speaker's table for Chicago Chapter's December 3 meeting in Huyler's Restaurant are (left to right) First Vice-Chairman Clare Bryan, James F. Lincoln, Jr., and William J. Conley (technical speaker), Lincoln Electric Company, Cleveland; and Chairman Frank A. Armstrong. At right, Mr. Conley uses the blackboard to illustrate highlights of his talk on welded jigs and fixtures.



1346 Woodruff Ave.
St. Louis 14, Mo.

Dear Mr. Potter:

Having returned to civilian life after serving in the Army Air Forces in Italy, I would like to thank you and the A.S.T.E. staff for your efforts in sending me THE TOOL ENGINEER *and all other Society news.* THE TOOL ENGINEER *has always reached me and it helped to make much of my spare time interesting and enjoyable while serving overseas. It helped in keeping me informed of the latest developments in the tool engineering field, so that I can again find my place in civilian life.*

F. M. Scott

I am anxiously awaiting publication of the "Tool Engineers' Handbook" of which I hope to make good use.

I am also very much interested in the A.S.T.E. Directory. Through its pages, I expect to locate many of my long-lost friends.

Very truly yours,
Floyd M. Scott
St. Louis Chapter

* * *

Reg. Hq. 34 Inf. Reg.
A.P.O. 24, c/o P.M.
San Francisco, Calif.
(Matsuyama, Shikoku, Japan)

Dear Sir:

I wish to acknowledge the receipt of your interesting letter. Indeed, I shall be looking forward to receiving THE TOOL ENGINEER *each month.*

In your letter you asked if I would relate a few of my active combat experiences. There have been many; however, there is one which might be of interest to you.

This action took place on June 19, 1945, on the island of Mindanao, the Philippines. At the time I was a "combat medic," assigned to K Company, 34 Inf. Reg., 24 Div. It was 0800 and we (1st Platoon) had just received our task for the day—a combat patrol, to feel out enemy strength three miles to the northeast.

We had proceeded through thick jungle growth about one mile when we were pinned down by heavy enemy machine gun and rifle fire. In this action our platoon Sergeant was seriously wounded and lay thirty feet from the Japs in an open field.

I was at the rear of the patrol and proceeded immediately to the wounded man, under intense Jap fire, most of which missed me as I crawled along the ground. However, one shot found its mark, striking my helmet. For a moment I was frightened, but moved forward until I reached my injured comrade.

Giving him first aid, morphine, being shot at by Nips, and hearing Jap voices but a few yards away proved to be an ordeal. We dragged the suffering man back a short distance. However, this proved to be too painful for the patient. Therefore, I stood up and carried the Sergeant to safety. Why the enemy didn't seize this opportunity to shoot me is something I still ponder over today.

Best wishes,
Pfc. Erwin J. Krause
AS 31471213
Hartford Chapter

* * *

CASU (F) Eleven
c/o Fleet Post Office
San Francisco, Calif.

Gentlemen:

THE TOOL ENGINEER *just came a couple of days ago and it is good reading. It keeps me hep as to what is going on in tooling circles back home.*

I notice that all the letters in "The PX" are written by the Army, and they are interesting. But where are all our members who are in the Navy? Our outfit is servicing Navy aircraft on Yonaboru air strip on Okinawa. I have been helping to keep the radio and radar in operation.

"The PX" is a good feature in the mazagine and I hope you keep it up as long as there are members in the services. I hope enough of the members write in to keep the column going.

The Society has done a swell job with the magazine and has published many interesting and instructive articles.

Best regards to my fellow members,
Edward Hucik, ART 2/c
Cleveland Chapter

Dies Interchangeable On Inclinable Press

Flint, Mich.—How the inclinable press lends itself to greater economy and safety in many production stamping jobs was very clearly presented to Flint Chapter by Joseph I. Karash, Plant Engineer, Reliance Electric & Engineering Company, Cleveland, Ohio, and speaker at the December 13 meeting of the Chapter. Mr. Karash's subject was "Design of Dies for Inclinable Punch Presses."

In his discussion, Mr. Karash pointed out that special knock-out pins must be specified in ordering new presses or built into old ones. When presses of this type are introduced, he stressed, equipment should be carefully studied so that knock-out pins could be located on all machines according to a definite plan. This tends toward interchangeability of dies from one machine to another, he indicated.

The speaker augmented his lecture with a selection of excellent slides, and answered many question from the audience.

Mr. Karash, who is Chairman of Cleveland Chapter, ASTE, is the author of the recently-published book, "Analysis of Drill Jig Design."

During his stay in Flint, Mr. Karash was escorted on a tour of the Bendix Aviation and Universal Electric plants in Owosso, Michigan, by Flint Chapter Chairman Michael Skunda, Membership Chairman Arthur Close, Public Relations Chairman Lionel Kitchen and Standards Chairman Daniel Green.

At Bendix the group saw conversion from wartime production of large aircraft carburetors to manufacture of automobile carburetors. The Universal factory is continuing to supply the government with motors.

U. S. Excels Europe In Cemented Carbides

Cincinnati, Ohio — Harry Crump, Assistant to the Vice-President in Charge of Sales, Carboloy Company, Detroit, and a member of Detroit Chapter, ASTE, addressed the December 11 meeting of Cincinnati Chapter. Mr. Crump's subject was "Cemented Tungsten Carbides of Today and Their Applications."

Harry Crump

The three methods of manufacturing tungsten carbides — cold press, hot press, and extrusion—were thoroughly explained by the speaker. He stressed special applications such as in dies and wear parts of machinery, quoting many examples of wartime uses.

At the conclusion of his technical talk, Mr. Crump related his experiences during his four-month postwar trip to Europe to study the manufacture and application of cemented carbides in Germany. The United States, he commented, is far ahead of Europe in this field.

Joseph T. Ware, Assistant Manager, Cincinnati Office of the Social Security Board, was the coffee speaker. Mr. Ware explained "How to Protect Your Interests under the Old Age and Survivors Insurance Program of the Social Security Act."

Several members of Flint Chapter linger at the conclusion of the December 13 meeting to ask further technical questions of Joseph I. Karash, Reliance Electric and Engineering Company, Cleveland, and speaker for the evening. ASTE'er Karash discussed the "Design of Dies for Inclinable Punch Presses." Left to right are: Standards Chairman Daniel Green, Elmer Liberty, Education Chairman Stuart Hall, Public Relations Chairman L. A. Kitchen, Mr. Karash, Chairman Michael Skunda and Carl Heckman.

Builders of A. S. T. E.

Walter F. Wagner, President, 1938-39

By O. B. JONES, *Society Historian*

WALTER F. WAGNER'S chapter in the Presidents' history of ASTE appears on this page. It needs no amplification. It pictures another year's growth of the organization whose roots were then beginning to penetrate all phases of industry, to spread and deepen, constantly drawing ever-increasing nourishment for more and more branches.

O. B. Jones

Subsequent chapters in the series by the Presidents will broaden the picture and deepen its coloring to bring into relief the details which, to them, were outstanding.

The really outstanding thing about the Society, in my humble opinion, has been and is, the quality of its leadership. It has had wonderfully good Presidents. Walter Wagner was among its best.

His account of his administration in 1938-39 follows:

"Without any display of personal ego on my part, I believe that I could write several volumes about ASTE, appraising the worth and distinction achieved by this comparatively young Society during the relatively few years of its existence.

Helped Organize ASTE

"My relationship with the Society began with its organization when about 35 Tool Designers and Master Mechanics met to discuss the possibility of a society through which they could advance, promulgate, and further the arts and sciences of Tool Engineering, thereby promoting all the mechanical phases in the industrial field. This idea, which proved commendable, is the basis upon which our Society is today established.

"In those early days we swayed and floundered about, holding meeting after meeting, discussing our problems long into the night. Many a stormy session ended without a satisfactory conclusion. Many committees had to be formed and, for a time, practically all the members were officers. I personally served as a Director each year until I became President. During these years I was also obliged to act as chairman of several committees.

Prospects Favorable

"Despite the many setbacks involved in organization effort, we knew we had a sound plan. We knew there was an immense field of individuals who would be interested and eligible for membership in such a society. This gave impetus to our determination to establish ourselves, and a self-assurance that we were destined for success.

"There are many today who deserve mention and much credit for their work in the early days. Some of these men are intimately known by a few, but, unfortunately, unknown by most of our membership.

"This is natural in any growing organization, but nevertheless, I must reflect upon the laudable spirit of these men in shouldering the responsibility of cementing the foundation of our Society. I could mention many names, and urgently desire to do so; but, fearful of overlooking a few who deserve equal credit, I will leave this record for posterity.

"When I was elected President of ASTE, I must confess that it came as a shock. While I had accepted many offices in the Society, I had always felt that I would not go beyond the Second Vice-Presidency. My reason for stopping here proved imaginary and without foundation.

Elected in Absentia

"As I was vacationing in Florida, I did not attend the Directors' Meeting in March of 1938. At this time, I want to express my thanks to Al Sargent, Joe Siegel, Bill Smila, Frank Crone, Bert Carpenter and several others whose campaigning and confidence elevated me from the Second Vice-Presidency to the Presidency. I was extremely proud of their faith in my ability to hold this office, although I was fully unprepared and hesitant to accept such an important undertaking at the time.

W. F. Wagner

"My year in office was perhaps the most eventful and interesting period in my entire life. Fortunately I had the support of a wonderful group of teammates in the National Office.

"My First Vice-President, James Weaver, who was extremely busy on an important assignment in Pittsburgh, was never too busy to discuss matters of importance concerning the Society. He made many trips to Detroit and answered many long-distance calls, with me on the other end of the line. This same James Weaver was the man who fostered the idea of the Machine and Tool Progress Exhibition which has become one of the Society's major activities.

Spoke Frankly

"My first Membership Meeting was held in Detroit and is still fresh in my memory. I found it timely to remind the members, 'straight from the shoulder', about the status of the Society, financial and otherwise; that we were assuming more responsibility, and that certain undertakings were imperative in order to sustain ourselves.

"We realized at the National Office that we were taking some bold and daring strides. We had decided to hold another Tool Show, but of larger proportions than the one of the previous year. The Show was to occupy the entire Convention Hall Building at Detroit.

"From the pattern set by the earlier Show, we knew that success was practically assured, but, nevertheless, there was an element of chance involved.

"We held our show. It was a huge success, accommodating 250 exhibitors. Many others were turned down for lack of space. There were 75,000 registered visitors, making it profitable from a financial standpoint and boosting the Society's prestige tremendously.

"Before going any further, I want to pay solemn tribute to the late Ford Lamb, our Executive Secretary at that time. His untiring effort and astute judgment, always exercised calmly and wisely, will be a lasting memory to many of us. Mr. Lamb has gone to his reward, but the impression of his association with ASTE will always be remembered.

Society Expanded

"During the year, our membership doubled, and the Society extended farther across the continent, adding new Chapters in several cities. Becoming better recognized, we had little difficulty in obtaining eminent speakers such as W. J. Cameron of Ford Motor Company, William Knudsen of General Motors, and Dave Wallace of Chrysler Corporation.

"We undertook to promote and sustain technological development in the mechanics of industry. In this, we were motivated by the knowledge that certain demagogues in our legislature were discouraging mechanical improvements in industry on the fallacy that they were detrimental to labor in general.

"Going into the matter rather extensively, we organized a fact-finding committee composed of outstanding industrial executives, writers, and educators. This committee made an exhaustive study and investigation of the subject, and held many discussions. Articles, concerning their findings, were published in some of the best mechanical journals.

Banquet Heavily Attended

"In the Fall of 1938, we conducted our Semi-Annual Meeting in Pittsburgh, overtaxing the capacity of the hotel banquet hall. This was a memorable affair, attended by the Mayor of Pittsburgh who gave a very encouraging speech. But no event of the year was greater than our Show and all the accompanying ceremony.

"Before the official opening of the Show, there was a preview followed by a banquet in the evening, which was well attended by many outstanding business, civic, and industrial leaders from all parts of the country. Admittance was by invitation only. The banquet speaker was Dr. Harold Moulton, President of the Brookins Institute, a group of professional fact-finders. Dr. Moulton's address on technocracy and its effect upon employment and our standard of living produced a lasting impression upon those who were present.

Inspired Greater Efforts

"This talk, along with the survey our fact-finding committee had made, gave us added impetus to further the study which had such an important bearing on the general welfare. It is my belief that our Society should continuously promote this subject by keeping it alive with data in our journal from time to time.

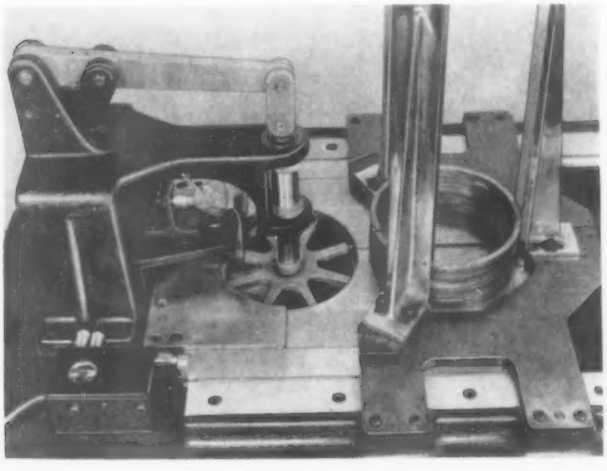
"We Tool Engineers are the pioneers on the frontier of economic development. For every invention developed for public use, there are probably 1,000 inventions in tooling and machines required to bring it within the reach of the consumer. As long as there still are people who do not have the things they want, production capacity should be increased. But the world moves fast, and sometimes articles are obsoleted before new machinery has been devised for their production."

TOOLS OF TODAY

Automatic Piston Ring Inspector

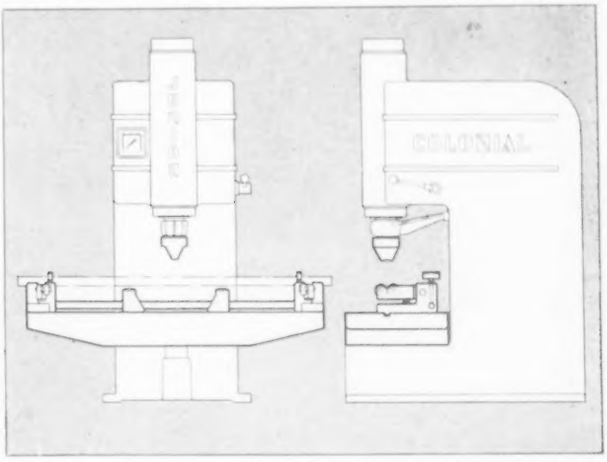
The Sheffield Corp'n, Dayton 1, Ohio, has developed a GAGING MACHINE for the full automatic checking of piston rings. This machine segregates the piston rings into three groups: acceptable periphery and gap; reject gap and, reject periphery because of failure to meet requirements. Electronic circuits, photo-electric cells, micro-switches, solenoids and relays are incorporated in the automatic cycle to actuate the gaging and selector devices. The device can be set for whatever tolerance is desired.

Above, the complete machine. Note "accepts" and "rejects" at floor. Below, detail of inspection head.



New Straightening Attachment

FLEXIBILITY AND working range of Colonial "Junior" **BROACHING** and **ASSEMBLY PRESSES**, product of *Colonial Broach Company*, Detroit, have been considerably increased by a straightening attachment, which is now available for all Colonial "Junior" presses and which may be used on the bench model, illustrated, or on the base type machines.



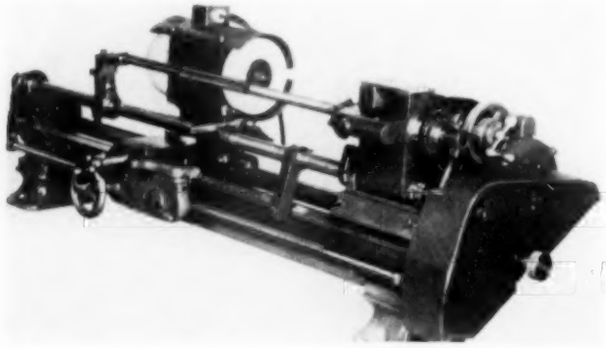
Changeover, from assembly or broaching to straightening, is quickly effected by the simple expedient of placing the self contained, single-unit straightening fixture on the platen of the machine. Especially suited for straightening work of comparatively small diameters, the fixture extends beyond the platen and provides ample support for workpieces considerably longer than the standard platen. Capacities range from 1 to 4 tons, and while the attachment may be bolted down, if desired, this is not ordinarily considered necessary since design provides centralized balance.

Simple Foot Switch

A NEW INEXPENSIVE **FOOT SWITCH**—model MK—developed by *General Control Co.*, 1200 Soldiers Field Road, Boston 34, Mass., offers long life and trouble-free service for such industries as light machining operations, photo printing, communications equipment, and household appliances.

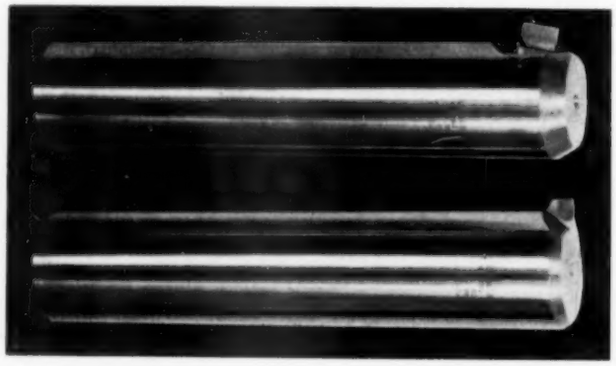
New Grinder for Long Taps

A NEW TAP GRINDER—Model No. 4—is a recent product of *Edward Blake Co.*, 634 Commonwealth Ave., Newton Center 59, Mass. Built like a lathe, with the grinder head mounted on a carriage, the machine is especially adapted to the sharpening of staybolt taps, long taper reamers, countersinks, multi-flute drills and other tools requiring relief grinding over long straight or taper surfaces. A locating device, for tap flutes, and a wheel trueing device are included.



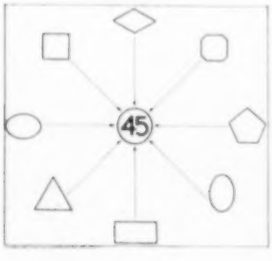
New Weddell Boring Bars

TRI-BITS are now applied by *Weddell Tools, Inc.*, Rochester 9, N. Y., to boring bars. The triangular tool bit is locked securely into a Vee by a single lock screw. Boring bars are made standard with plain, straight or tapered shank. They are also made special, with plain or strip pilots integral in the body, or in combination with other tools, as facing and chamfering heads or hollow mills.



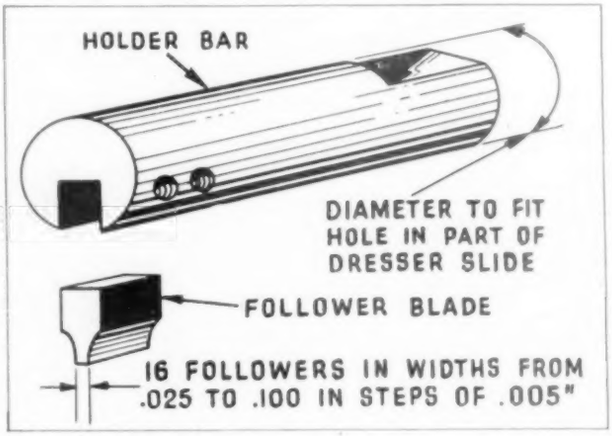
Simpler Operator's Stamps

NEW **IDENTIFICATION STAMPS** are offered by the *New Method Steel Stamps, Inc.*, 145 Jos. Campau, Detroit 7, in sets of numbers ranging from (1) to (99) and with different border designs in the following sizes: 5/32", 5/16", 1/4", and 5/16" for the border.



New Cam Follower

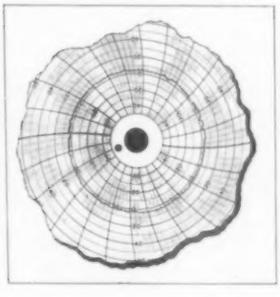
THE HOOTMAN CAM FOLLOWER, shown below, is designed to provide greater flexibility and control on profile grinding with Cincinnati Centerless grinders than is ordinarily obtained with the cam follower furnished as standard equipment with the machine. The Hootman follower, which is manufactured by *Profile Products Co.*, and of which Koebel Diamond Tool Company, Detroit 3, is sole distributor, is claimed to easily and accurately control shoulder radii, squeeze radii forms and various other step forms.



Among the many features claimed are: It facilitates set-up; width of form between radii may be easily changed for roughing and finishing; wear of diamonds, which causes form to broaden, may be compensated for, thus enabling more pieces to be ground between diamond tool changes. A new diamond may be adjusted to form easily, quickly and accurately, with considerable saving in down time, grinding wheels and diamonds.

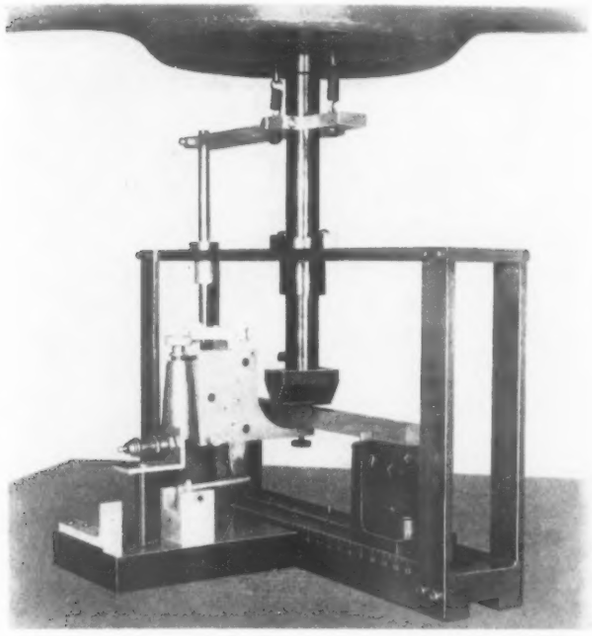
New Dew Point Recorder

A NEW **RECORDER**, offered by the *Surface Combustion Corp'n*, Toledo 1, Ohio, provides a virtually continuous record of humidity within a temperature range from −70° to +60° F. The presence of impurities in the furnace gases, such as hydrogen sulphide and sulphur dioxide, has no effect upon the Recorder's accuracy. Hence, an analysis of the furnace gases is unnecessary. This apparatus is especially applicable for furnaces utilizing prepared gas atmospheres, or whenever dehydrated air or a gas mixture of controlled moisture content is desirable.



Deflectometer for Testing

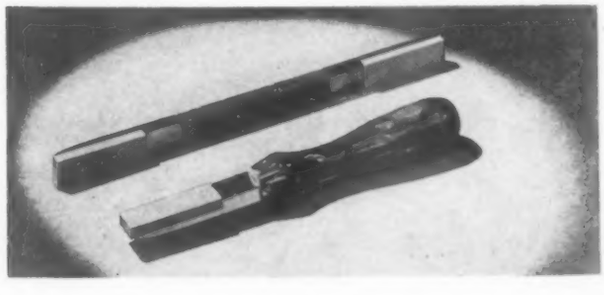
SOUTHWARK DIVISION of the *Baldwin Locomotive Works* has developed a combination **FLEXURE TOOL AND DEFLECTOMETER** for testing the many different molded plastics, plastic laminates, and woods. The new instrument will make tests in bending in accordance with the latest federal specifications and those of the A.S.T.M., and will fit any testing machine.



The deflectometer measures the deflection from the center of the specimen and conveys this to an autographic stress-strain recorder which gives the load deflection curve. An important feature permits the operator to adjust the magnification of the deflection in multiples of 5, 10, 20, 50, 100 and 200 times. The high magnification ratio is used for very stiff and brittle materials that deform only slightly before breaking. The deflection, therefore, is measured in terms of thousandths of an inch. This low magnification permits recording large deflections which may be as much as two inches with very flexible materials.

Pocket Size Hand Hones

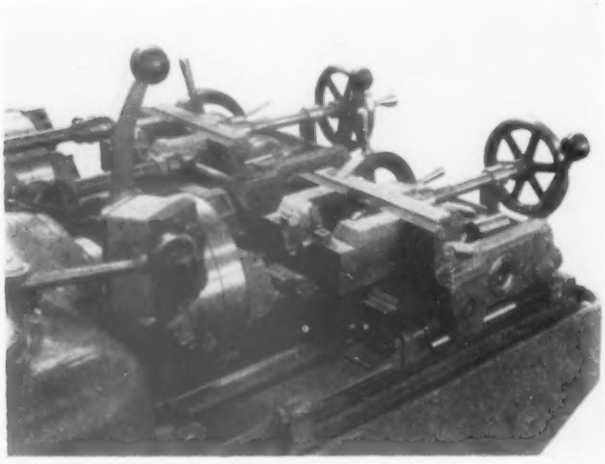
POCKET SIZE **VITRIFIED DIAMOND HAND HONES** are now available from *Bay State Abrasive Products Co.*, Westboro, Mass. Exceptionally good for touching up carbide tools before they become too dull, both pocket size models are available with diamond section 7/16" wide by 1" and 1½" long, with 1/16" depth of diamonds. One style has a hone at both ends, and both styles are supplied with plastic handles and furnished in a handy leather pocket case.



New Landmaco Work Holder

THE *Landis Machine Company*, Waynesboro, Pa., has recently developed a special work-holding fixture for use in connection with the **LANDMACO** Threading Machine to thread hypoid driving gears.

The fixture comprises a traveling center, located within the bore of the head and machine spindle, combined with a splined bushing to drive the work piece, and a manually operated work center on the machine carriage combined with a cradle type support to locate the work piece for easy alignment with the work center.



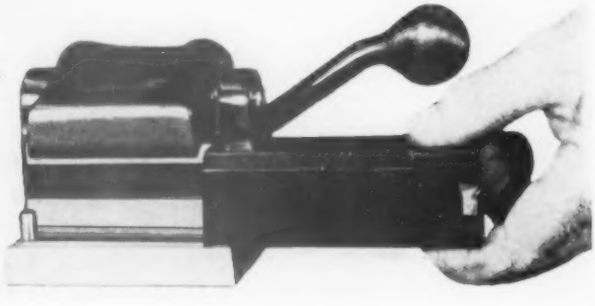
In threading hypoid driving gears, the tolerances require a high degree of concentricity between the thread, shaft and gear. The part presents no satisfactory driving means other than the splined end of the shaft and, therefore, the drive is located within the bore of the die head.

In operation, the work is placed on the supporting bracket and the work piece advanced with the carriage operating hand wheel until the splined end of the shaft engages the splined sliding bushing and center within the bore of the head. A hand wheel is then employed to advance the rear center to engage the gear end of the work. The complete chucking operation can be accomplished in only a few moments time.

Efficient Toolholder

DESIGNED BY *Bakewell Products Co.*, 2429 E. 14th St., Los Angeles 21, California, for faster operation and more positive repeating on close tolerance engine lathe jobs, the new **TOOLHOLDER** has speeded production and reduced scrap.

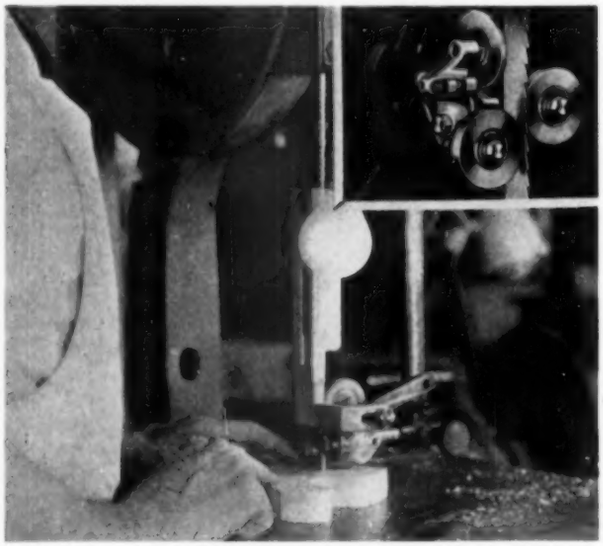
The holder consists of a quick acting vise which is mounted on the lathe compound, without machining, and into which Bakewell toolbit holder bars are positioned against a positive stop and held in place on hardened surfaces with rigid three plane support.



Saw Guide and Safety Guard

A BAND SAW GUIDE and metal safety guard, especially adapted to metal and plastics as well as wood, and adjustable to blocks ¼" to 1½" wide, is announced by the Safety Division of *The Boyer Campbell Company*, Detroit. As shown in the cut away view, side guide wheels are mounted staggered to eliminate binding. A grooved back wheel holds the saw in position, with all wheels equipped with double sealed, permanently lubricated ball bearings.

Positive adjustment of the mounting arms on the supporting bracket is provided by a set screw that exerts pressure against a 90° pin that, in turn, presses against the adjusting screw. This eliminates any tendency to loosen or crack. Operation is said to be unusually smooth, producing clean, accurate cuts and reducing breakage to a minimum.



New Vertical Motor

THE CROCKER-WHEELER DIVISION of *Joshua Hendy Iron Works*, Ampere, N. J., announces a new **VERTICAL DRIP-PROOF MOTOR** which is rated at 40 C rise continuous duty with a 15% service factor. It is designed for operation from 60 to 50 cycle, 3 or 2 phase circuits at all standard voltages. At present, a NEMBA "B" flange type mounting, up to and including the "284" frame, and a NEMA "C" face type mounting up to and including the "326" frame is available.

All ventilating openings of this new line of motors are shielded against the entrance of dripping liquids and falling particles. Oversize ball bearings are provided to carry thrust in addition to the rotor, and the use of the company's patented centrifugal bearing seal permits the use of softer grease for better lubrication and longer bearing life.

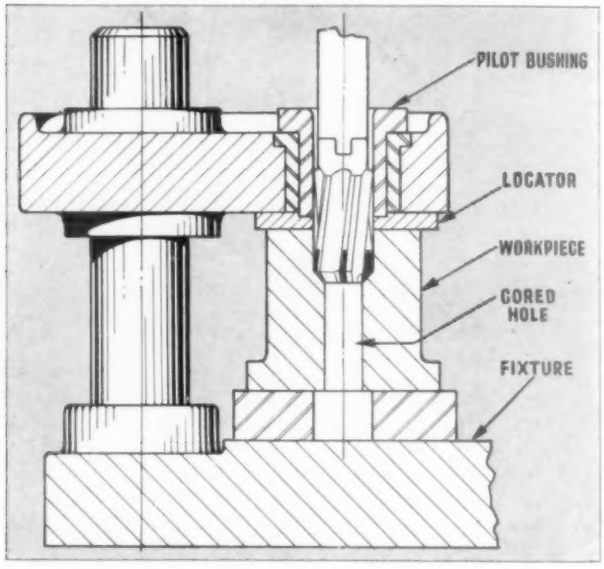
A new recessed junction box, which provides ample room for making electrical connections, is employed in the motor's design. The rotor, with bars, fans and end rings cast in one operation from aluminum alloys, is used. Other features include: heavy cast frame construction and coils protected.

Carbide Core Drills

SPECIALLY DESIGNED carbide-tipped core drills, specifically intended for the drilling of hard, scaly cast iron, have recently been introduced by *Tungsten Carbide Tool Company*, 2261 Joy Road, Detroit 6. Since, however, dimensional requirements vary considerably, these drills are made to order and not carried as stock.

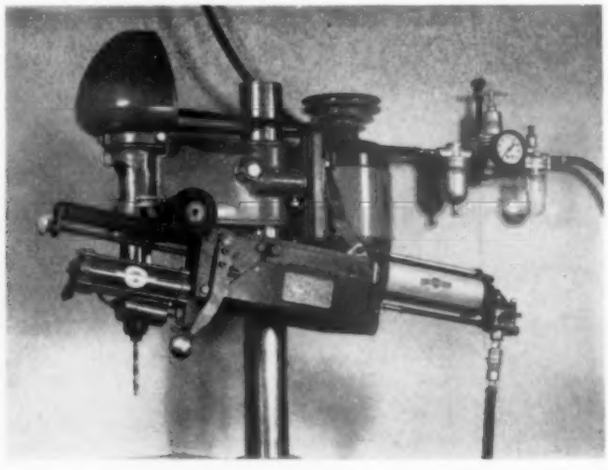
When core drilling with hard or scaly cast iron with standard types of carbide-tipped core drills, the drills tend to chip and break down on the cutting tips. To overcome this, the new TCT drills combine the best effects of various carbide grades, tool shapes, shank materials, tool angles and number of flutes to increase life expectancy.

It is claimed, for instance, that on one particular application—drilling 15/8" holes 5/8" deep—the run was 10,000 holes between grinds, and that, in breakdown tests, as high as 50,000 pieces were obtained between grinds. Such extremes, however, are not recommended by the company.



New Power Drill Press Feed

A "STEPLESS-RANGE" **POWER FEED** for use on drill presses, milling machines and surface grinders is now available from the *Bellews Co.*, 861 E. Tallmadge Ave., Akron, Ohio. A hydraulic resistance unit assures a smooth, steady feed without whip or jump.



North East West South in Industry

CENTRAL STATES ENGINEERING CORPORATION, with offices at 4612 Woodward Ave., Detroit, has been organized with E. M. Beyma as President and Gen'l Mgr., John Allman as Vice Pres. and Ch'f Eng'r, and Frank Querry as Sec'y-Treasurer. With a staff of fifty engineers, the organization will devote itself to the design of tools, dies, fixtures, special machinery, manufacturing processes.

E. M. Beyma, for the past ten years Vice Pres. and Executive Eng'r of the Pioneer Eng'g & Mfg. Co., is a charter member of the A.S.T.E. and a past Director. Allman (right) and Querry are also from the Pioneer organization, the former, an active member of the A.S.T.E., having served five years as Ass't Ch'f Eng'r and the latter ten years as Sec'y-Treas. The three officers are veteran tool engineers and fully experienced in their field.

EDGAR W. BARTZ, formerly of East Pittsburgh and Trafford, Pa., has been appointed welding specialist for the San Francisco Bay area by the *Westinghouse Electric Corp.* Mr. Bartz joined Westinghouse in 1931 and since 1938 has specialized in electric welding electrodes and materials.

Charles G. Bellerose (left), formerly with the Connecticut Telephone & Electric Co., has been appointed field representative of *The Allen Mfg. Co.*, Hartford, Conn., makers of dowel pins and hex-socket screws. He will serve the Connecticut area. Coincidentally, **Ralph D. Case, Jr.** (right), formerly with the United Aircraft Div'n of Pratt and Whitney, has been appointed Allen representative to serve northern New York State.

CONSOLIDATED VULTEE AIRCRAFT CORPORATION is entering the general manufacturing field while continuing to turn out commercial, personal and military aircraft.

A. R. ZAPP, carbide products manager of the Firth-Sterling Steel Co., McKeesport, Pa., has been awarded the annual medal of The Wire Association for the "most meritorious technical paper of the year written by a member of the association on wire production and fabrication." The paper, in three parts, describes for the first time the complete history and evolution of sintered carbide dies and their multiple applications in this field.

F. G. GERARD has been elected vice president in charge of operations of the *Washington Steel Corp'n*, Washington, Pa., as announced by T. S. Fitch, president. Mr. Gerard was formerly plant superintendent of the Eastern Stainless Steel Corp'n, Baltimore. The Washington Steel Corp'n is a new company organized to produce stainless steel in sheet and strip form.

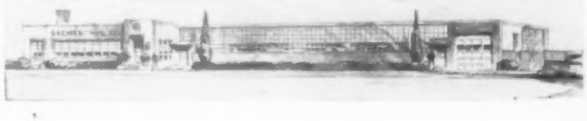
JOHN BROWN, president, announced a change in name of Van Tuyl Engineering Corp'n to Vantco Corp'n. This organization maintains offices in Los Angeles, Detroit and Mexico City. The latter two offices are being revamped in the Corpn's conversion from wartime to peacetime activity. Mr. Brown announced an extension of the scope of his organization's engineering services to the industry.

FORS & SAVAGE, INC., with offices at 2832 E. Grand Blvd., Detroit, have been appointed representatives for Metropolitan Detroit and adjacent territory by Gerotor May Corp'n, of Baltimore, Md., and Logansport, Ind., manufacturers of air and hydraulic equipment.

Wm. J. Fors and W. B. Savage are A.S.T.E. members and well known in industry. Mr. Fors (left) is a charter member and a past Director who served as the Society's first Nat'l Treasurer.

CLARENCE SNYDER, president of Snyder Tool & Engineering Co., Detroit, has announced the following promotions: **LARRY S. ANDRICH**, right, to Vice-President and general manager; **GEORGE H. WHITEHOUSE**, left, sales manager, assisted by G. A. Melling, Jr., and William F. Pomeroy, and **W. C. OBEREM** to chief engineer with John F. Benner as assistant. Mr. Andrich joined Snyder 16 years ago, and is considered an authority on special machine tools.

As an expansion move, the **DREMEL MFG. CO.**, Racine, Wis., is to start on the construction of a new plant. The company manufactures portable electric tools.



GOOD READING

A Guide to Significant Books and Articles of Interest in the Trade Press

WROUGHT ALUMINUM ALLOYS—Their Selection and Application, by O. L. Mitchell in February issue of *Materials and Methods*, covers in rather complete detail approximately 20 principal wrought aluminum alloys, the forms in which they are available, their characteristics and the general rules covering their working and finishing.

Also, in the same issue, **AUTOMOBILE ENGINE MADE OF BRAZED STAMPINGS**, by Harold A. Knight, describes a new light-weight, 4-cylinder gasoline engine made of 120 stamped steel pieces joined together by copper brazing. This engine is rated at 26 h.p. and weighs, stripped, 58 lbs.—half the weight normally required for this rating. The engine is primarily for use in the Crosley car, but, due to its compactness and light weight, it is also expected to find many applications in other fields.

ABRASIVE DUST COLLECTION, by C. C. Hermann in January *Tool & Die Journal*, points out the necessity of protecting the health of employees in grinding departments and lists the financial benefits to the employers. In the same issue, **NITRIDING FOR LONGER TOOL LIFE**, by George T. Long, is a brief discussion of salt baths, proper temperatures and treating time used in nitriding high-speed tool steel tools.

NEW CRUSH DRESSING APPLICATIONS, in January *Machinery*, by Carl Linxweiler, is a discussion of crush-dressing of grinding wheels by means of metallic rolls having the desired contour of the ground work. The making of master crusher rolls, materials for rolls, coolants for crush-dressing grinding wheels, thread and form grinding are included in the discussion.

GENERAL REVIEW OF GERMAN METALLURGICAL PRACTICES, by John H. Frye, *The German Cemented Carbide Industry in* 1945, by Prof. Gregory Comstock, and *German Tool Steel and Special Steel Industry*, by James P. Gill, are three articles in January *Metal Progress* that give a comprehensive picture of German methods, developments and failures of metal industries, due to the lack of coordination of efforts and government interferences with industry.

In the same issue, **COMPARATIVE STUDY OF ELECTRIC AND GAS-AIR METHODS OF SILVER BRAZING**, by Paul F. Berg, briefly discusses the advances of gas-air combustion methods and equipment and their applications. The author also compares open-flame gas-air operations with induction heating insofar as shop practice and equipment selection are concerned.

THE AUSTENAL LABORATORIES, INC., has published an interesting, illustrated booklet, called the *Microcast Process*, which should be of particular interest to metallurgists, engineers and production executives. The booklet traces the history and early applications of Microcast and, along with a pictorial step by step description, gives examples of intricate shapes produced of high melting point, non-machineable alloys. Copies may be had, free, by writing to Austenal Laboratories, Inc., at 5932 S. Wentworth Ave., Chicago 21.

THE GRINDING OF CEMENTED CARBIDE CUTTERS, by Raymond O. Catland in December *Western Machinery and Steel World*, is of interest to all users of cemented carbide cutters. The author's experience is supplemented with the results of the experimental work conducted at the California Institute of Technology, and the study of methods used by production shops in Southern California.

DRILLS AND DRILLING PRACTICE, Edited by R. A. Schafer, chief development engineer at National Automatic Tool Company, presents the latest practices in drilling. The material is drawn from years of practical experience in active applications of drilling, and applies specifically to manufacturing problems. As a whole, the work is a practical treatise on modern drilling techniques. Available from Natco, Richmond, Indiana, at 50 cents.

SHOP TERMS is a carefully prepared and profusely illustrated up-to-date machine shop dictionary. It contains formulae for the solution of right-angled triangles, trigonometric functions, rules for determining speeds and feeds—and, a table—of the recommended tool angles, feeds and speeds for cemented-carbide tools. The text was prepared by the Department of Education, *The International Business Machines Corp.*, and the book is sold by the *Syracuse University Press*, Syracuse, N. Y. Price 60 cents.

In the Micro World

THE PHOTOGRAPH illustrates the ultra-fine checking made possible by optical comparators. Here, a thread gage smaller than a thumb nail is being checked by a comparator at the Westinghouse East Pittsburgh Works. By a system of mirrors, the gage has been enlarged 100 times to facilitate study of its contours for absolute accuracy.

The instrument shown—and others equally delicate—are located in an especially designed laboratory in which the temperature is held at 68 degrees F., plus ½ degree F., the year 'round. Humidity is also held constant, enabling engineers to maintain tolerances within .000002". In addition, a Precipitron—the electrostatic air cleaner—is used in the air intake duct of the lab to eliminate entry of dust.

BULLETINS AND TRADE LITERATURE

Items briefed herein have been carefully selected for their interest and application. Unless otherwise stated, all are available, free, from the stated sources.

Practical Milling Methods, recently published by **SUNDSTRAND MACHINE TOOL CO.**, Rockford, Ill., is, to all practical purposes, an up-to-date engineering text book. The detail drawings of parts being milled enhance the value of this treatise.

Another excellent booklet is a *Report from Cincinnati Milling*, Vol. 2, No. 5, containing milling cast iron and steel with carbides. Obtained from **CINCINNATI MILLING MACHINE CO.**, Cincinnati, Ohio.

W. F. and JOHN BARNES CO., Rockford, Ill., has issued a pictorial review of *Special Machine Tools for Diesel Engine Metal Working Operations* which, while primarily intended for the Diesel field, will be of interest in all other fields. The various Barnes universal and special machine tools, built for multiple machining operations on Diesel engine parts, are briefly described. The sequence of operations on various jobs and tooling data are also furnished. Free copies upon request.

As a companion to a booklet on Cool-Cut Wheels, **ROBERTSON MFG. CO.**, of Trenton 5, N. J., have just published a catalogue on their "Cyclone" mounted wheels and points. The publication includes complete information on critical speeds, operating rules, and standard shapes and sizes. A special feature of the booklet is a detachable form which can be used to send information and sketches to Robertson with a request for a recommendation as to what wheel to use for a particular problem.

STANDARD OIL COMPANY (Indiana) has issued an Engineering Bulletin—MW-23—dealing with cutting fluids. Although primarily intended for the instruction of salesmen and service engineers, the bulletin contains information of considerable interest to the users of cutting fluids. This holds especially for selection and proper application to various materials and operations. Literature available from the Chicago office.

Durabonded coated abrasives are described in **NORTON COMPANY'S** *Grits and Grinds*, Vol. 36, No. 9. "Lightning" coated abrasives (on which the cutting grains are evenly dispersed and stand upright by means of a powerful electrostatic field) as a new development. The adhesive receives a treatment which hardens it and makes it more resistant to heat and less sensitive to high humidity. In the same issue, a series of tables specify proper wheels for various metals and different types of machines.

A manual—D-119—illustrating the finishing and servicing all types of *Carboloy dies*, is the latest publication of **CARBOLOY CO., INC.**, Detroit 32.

A new model *Chuck*, designed to hold shank sizes from No. 80 drill to ¼", without changes of any kind, has been announced by the **KETT TOOL CO.**, 5 E. 3rd St., Cincinnati 2, Ohio.

WESTINGHOUSE METALS AND ALLOYS is a recent booklet published by the *Westinghouse Electric Corp'n*, East Pittsburgh, Pa. Various metals are discussed in each of the five sections, with their physical and chemical properties tabulated. These new alloys have applications for communications and electronic equipment.

The *Electro-copying process* is described in two bulletins recently issued by **HUNTER ELECTRO-COPYIST, INC.**, Syracuse, N. Y.

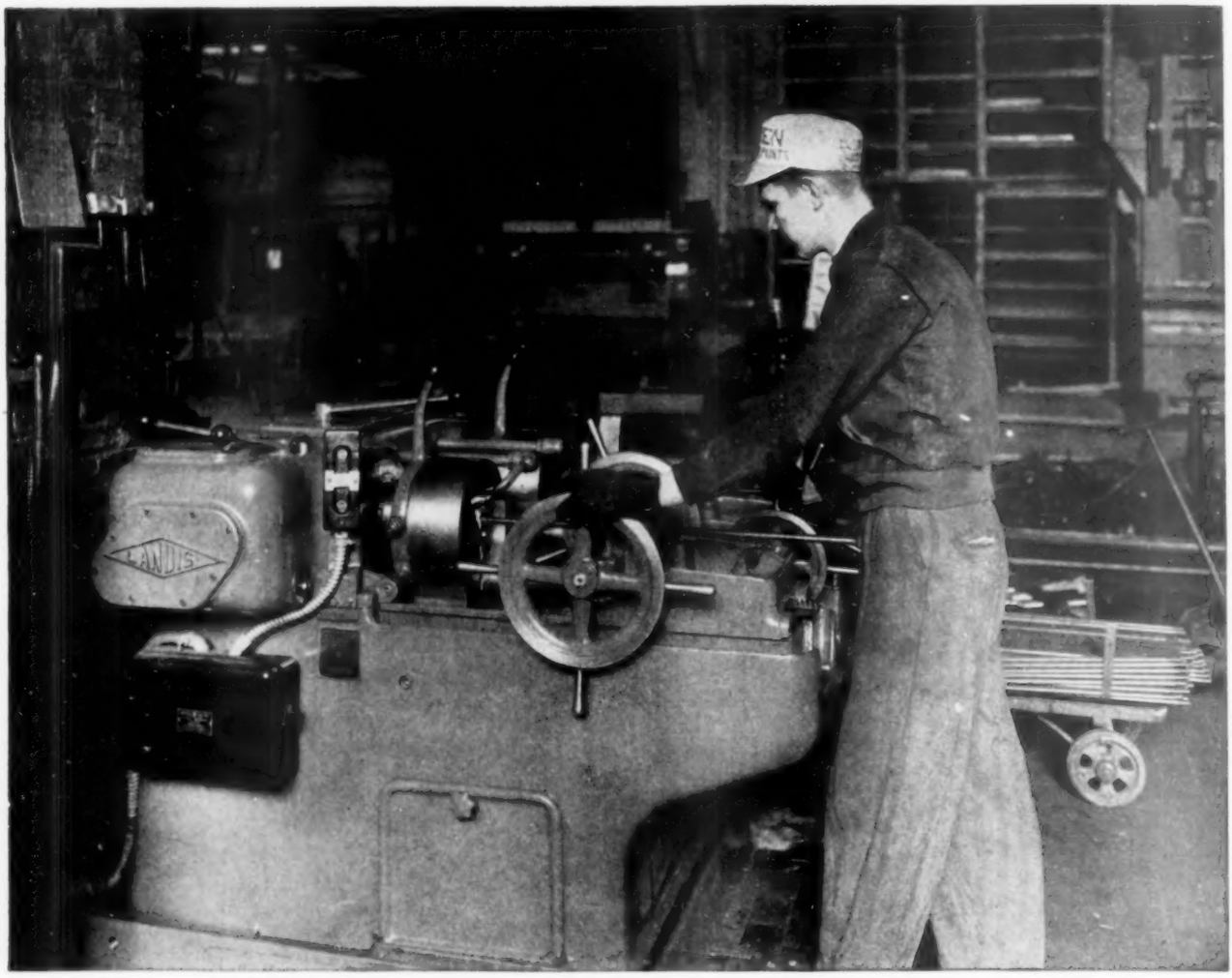
Two new bulletins, one on "Surface" *radiant tube heating* and the second on "Case Hardening," have been issued by the **SURFACE COMBUSTION CORP.**, Toledo 1, Ohio.

SCREW THREADS FOR HIGH-STRENGTH BOLTING, a bulletin on standards sponsored by SAE and ASME and approved by the Standards Association, is now available from the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

GEORGE A. TERRY CO., Buffalo, N. Y., has available an illustrated catalogue of angle and flexible drilling attachments.

NAGLE BROTHERS, Chicago, Ill., have issued a bulletin describing a new *Etching Marker* which provides speed, simplicity, legibility and neatness. Various applications of the new Marker are listed.

A practical manual, analyzing job demands and physical handicaps of veterans and civilians, is offered *at cost* by **DUNWOODY INSTITUTE**, Minneapolis 3, Minn., to all who are interested.



An All-Purpose Threading Machine . . . . . The LANDMACO

The Landmaco Threading Machine here illustrated is a general purpose machine. The thoroughly modern design, which permits quick set-up changes, makes it ideal for the short production run of tie-rods, a single rod for maintenance or a rush call for some special-threaded parts.

Its high operating speed assures unusual production figures in threading tough alloy steel jobs to close tolerances or in cutting the average commercial threads used in construction, reclamation and maintenance.

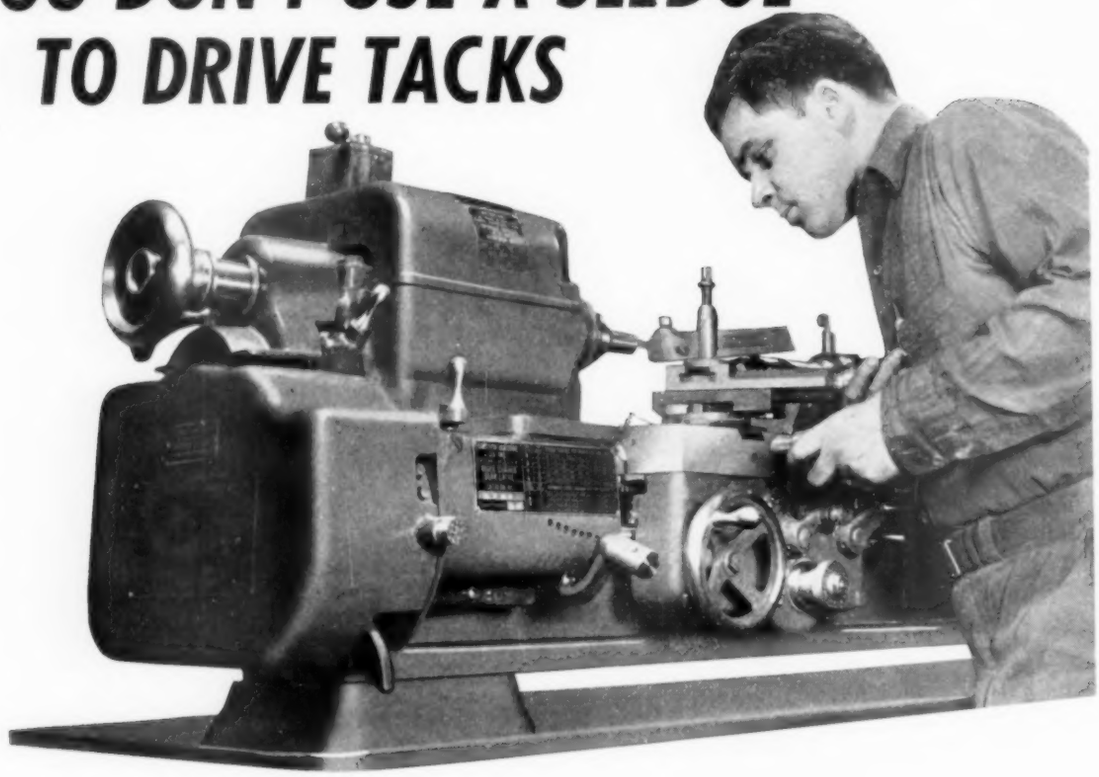
The Landmaco Threading Machine is accurate, fast, dependable and will handle all demands with a minimum of delay.

Write for Bulletin H-75

LANDIS MACHINE COMPANY, WAYNESBORO, PENNA, U.S.A.

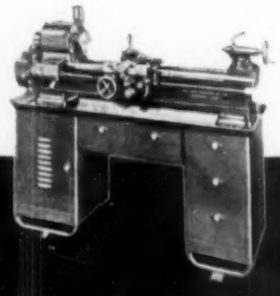
THREAD CUTTING MACHINES • DIE HEADS • COLLAPSIBLE TAPS • THREAD GRINDERS

YOU DON'T USE A SLEDGE TO DRIVE TACKS



There was a time when machine tools had to be heavy to be accurate but modern engineering and manufacturing methods have changed that. Today, the fully equipped shop has its big lathes for big work, and SHELDON S-56 Precision Lathes for small parts. With accuracy that will hold the closest tolerances and the stamina to stand up to continuous high speed operation, these smaller, handier, moderate priced lathes are cutting the cost of and increasing the hourly output of small turned parts.

FROM ANY ANGLE, A BETTER LATHE.



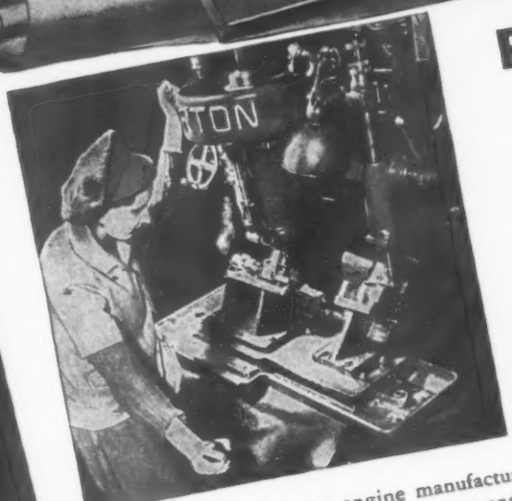
SHELDON MACHINE CO., INC.
4229 N. Knox Ave., Chicago 41, U.S.A.

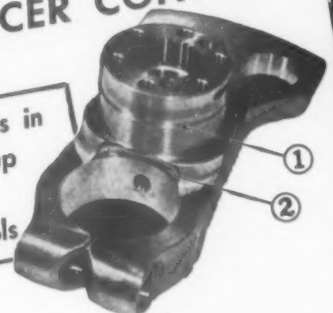
GORTON

SPECIALISTS FOR OVER 50 YEARS IN

Tracer-Controlled MILLING

PROFILE MILLING SIMPLIFIED ...by TRACER CONTROL





• A prominent airplane engine manufacturer cut production costs, saved tying up expensive machinery and conserved skilled workmen by profile milling this radius of an engine crankshaft section on the Gorton Duplicator. Semi-skilled help operated this machine, obtaining smooth finish on the profiling of the irregular channel contour (1) on the part shown at right, and the milling of the channel (2) below this contour.

The Duplicator was set up with a special master in order to eliminate changing tools or resetting the work. A special fixture was used to hold the work at an angle to allow cutter access in milling the channel.

The Gorton Duplicator is the ideal machine for handling jobs like this where uniformity in quality and high precision repetition of all dimensions is required.

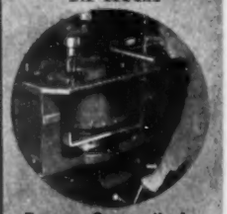
PRODUCTION DATA

Operations—Profile Mill .369" Radius and Mill Channel.
Machine—GORTON 9-J Super-Speed Duplicator.
Part—Rear of Crankshaft—Steel.
Cutter—Special .738" dia. Ball Cutter—4 Flute.
Holding Method—Special Fixture.
Feed—Manual.
Spindle Speed—500 r.p.m.
Stock Removed—1/8".
Floor-to-Floor Time—15 minutes per piece.

GORTON ENGINEERING SERVICE—

You are invited to consult Gorton engineers, without obligation, on your next production profile milling jobs. Gorton "Tracer Control" may give you the simplest, practical answer to lower cost production. Please submit part, print or specifications to your nearest Gorton Dealer or to the Gorton Factory at Racine, Wisconsin.

The *Right* Size The *Right* Type of Machine for Every Job...
From 2 oz. to 2 ton DIE BLOCKS



Tracer-Controlled MILLING

Tracer-Controlled DUPLICATING

Tracer-Controlled ENGRAVING

Tracer-Controlled ETCHING

GORTON ARMY E NAVY

GORTON *Precision* MACHINES

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George Gorton Machine Co.,
2602 Racine St., Racine, Wis.
Send me these free books
☐ Condensed Catalog
☐ Die and Mold Duplicators

Name..... Title.....
Company.....
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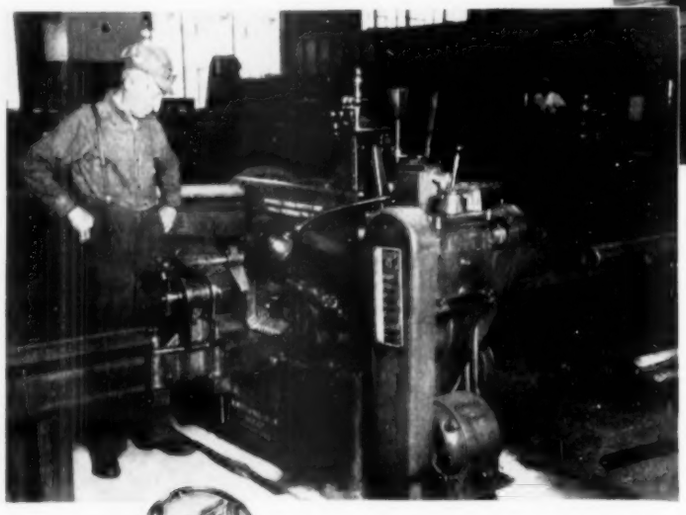
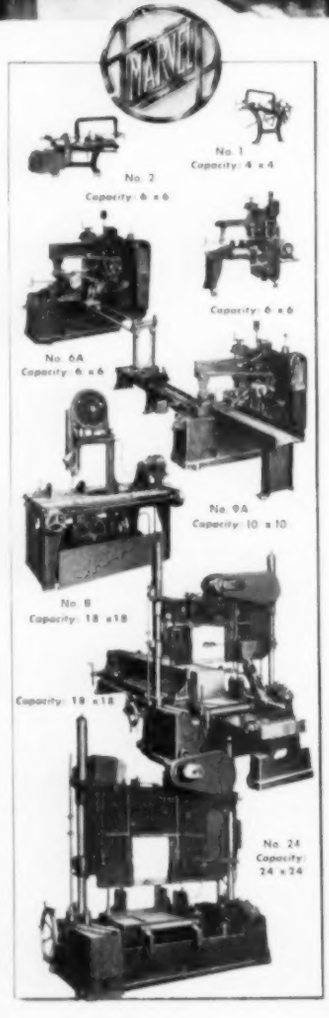
RAILWAYS ARE *Streamlining* THEIR SHOPS TOO!

(*Above*) MARVEL No. 9A Production Saw automatically cutting-off hollow iron into staybolts; 1" x 9", 30 bolts to the cut.



(*Left*) Cutting accurate lengths from 3½" steel tubing for spring and brake hanger bushings.



Railway shops are "re-converting," not to new products but to newer and more efficient methods.

Today, in the Paducah shops of the Illinois Central, for example, much cutting-off work is being done with MARVEL No. 9A Production Saws that feeds, measure and cut off identical lengths automatically with no more operator attention than is required by an automatic screw machine.

Operating "automatically," the Marvel No. 9A Saw illustrated above, has cut-off as many as 300 pieces of 1" round staybolt stock in a single hour. Supervision at the Paducah shops tell us that the machine paid for itself in the first 30 days and has been piling up dividends ever since. These extremely accurate and fast saws are not limited to production cutting-off work, because at any point in a "run," the automatic bar push-up can be dis-engaged, a miscellaneous cut made, and the production run resumed by merely re-engaging the bar push-up clutch.

The MARVEL System of Metal Sawing comprises 9 different types of metal-cutting saws; provides the complete answer to most metal sawing problems.

ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 Bloomingdale Ave. Chicago 39, U. S. A.

Eastern Sales Office: 225 Lafayette Street, New York 12, N. Y.

MARVEL SAWS

NEW TOP PLATE
Speeds Small Parts Production

New all steel hardened laminated top plate adds hundreds of production hours to life of work surface of electro-magnetic chuck.

Available on HANCHETT ELECTROMAGNETIC CHUCKS

at No Increase In Price!

CHUCKS
With Laminated
TOP PLATE
NOW READY
IN THESE SIZES

6" x 18"
6" x 24"
8" x 14"
8" x 25"
8" x 36"
8" x 48"

Other Sizes Available Soon!

GIVES YOU THESE ADVANTAGES

* Fine Laminated Top Plate Construction
* 22% greater magnetic work area
* More uniform distribution of holding power
* Holds even smallest work pieces firmly
* More work pieces finished per load
* Less possibility of work slippage
* Longer service life when top plate is furnished hardened (at slight extra cost)

See your nearest Hanchett dealer or write for Bulletin 045-1TB for detailed information.

HANCHETT GRINDERS — BIG RAPIDS MICHIGAN

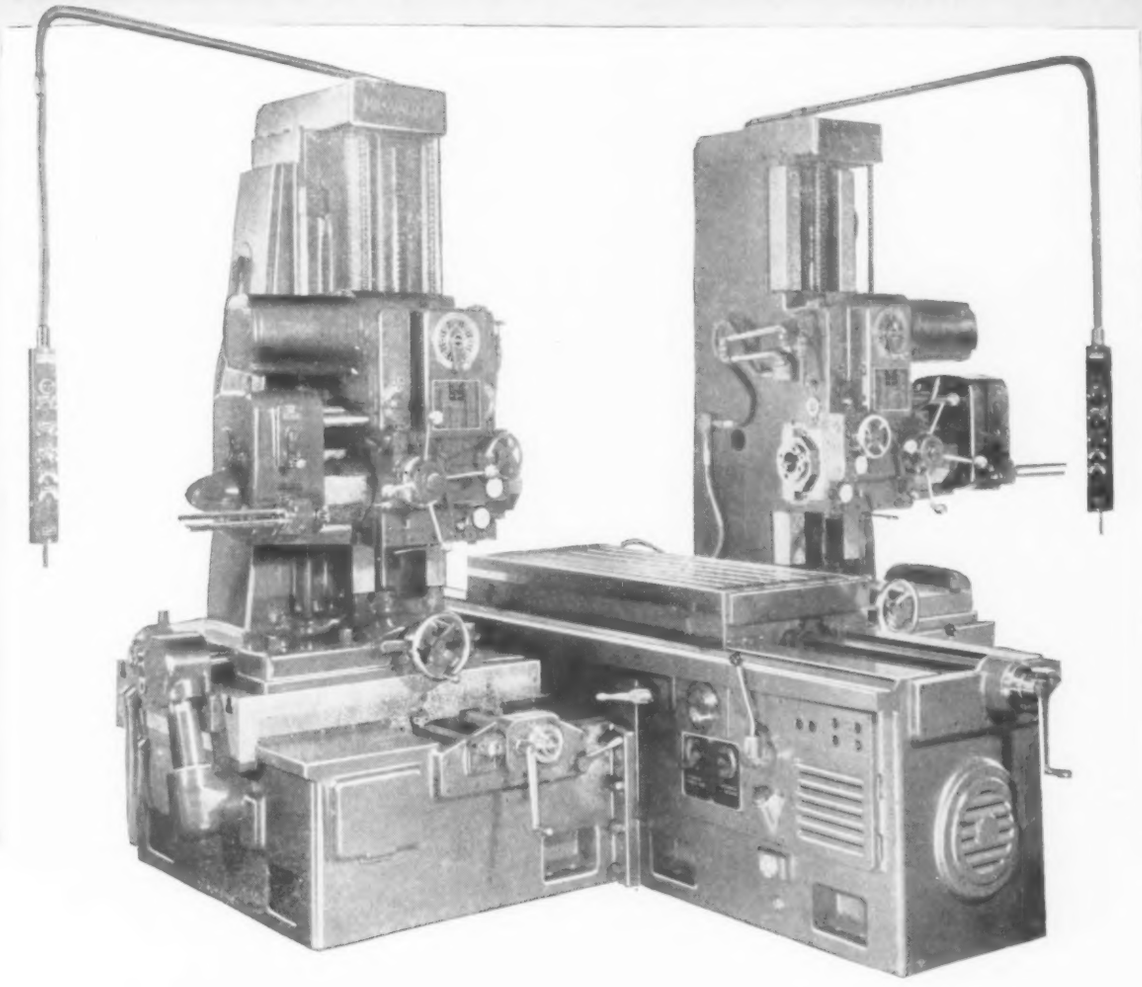
IF IT'S A FLAT SURFACE—THERE'S A HANCHETT TO GRIND IT

HANCHETT MANUFACTURING CO.
BIG RAPIDS, MICHIGAN U.S.A.

HANCHETT HERMETI-COIL MAGNETIC CHUCKS

Announcing the **KEARNEY & TRECKER**
Milwaukee

Model TT Precision Milling and Boring Machine



Scientifically constructed for accurate and convenient operation, the Model TT Precision Milling and Boring Machine enables the operator to mill and bore a workpiece from two sides without changing the setup — an answer to your difficult milling and boring problems that require exceptional precision. Convenient operation is of paramount importance on any machine tool. This machine provides dual table controls on each side of the bed. Each upright is a complete unit in itself with column and spindle controls. A swiveling control pendant provides complete control from the most advantageous operating position at each column.

Features of operation and construction that make this machine outstanding in precision operation and versatility are —

- The No. 50 National Standard spindle nose to accommodate modern milling tools.
- Spindle rotation of both spindles in either direction permit the use of right or left hand milling cutters.
- A wide range of speeds and feeds are available for the efficient use of modern cutting tools on a wide variety of operations.
- A thread cutting feature provides boring and thread cutting on two sides of a workpiece in a single setup.

Write for Catalog T11, a complete descriptive catalog on the Model T and the Model TT Precision Milling and Boring Machine.

BUILDERS OF MILWAUKEE ROTARY HEAD MILLING MACHINE • MIDGETMILL • SPEEDMILL • FACE MILL GRINDER • AUTOMETRIC BORING MACHINES

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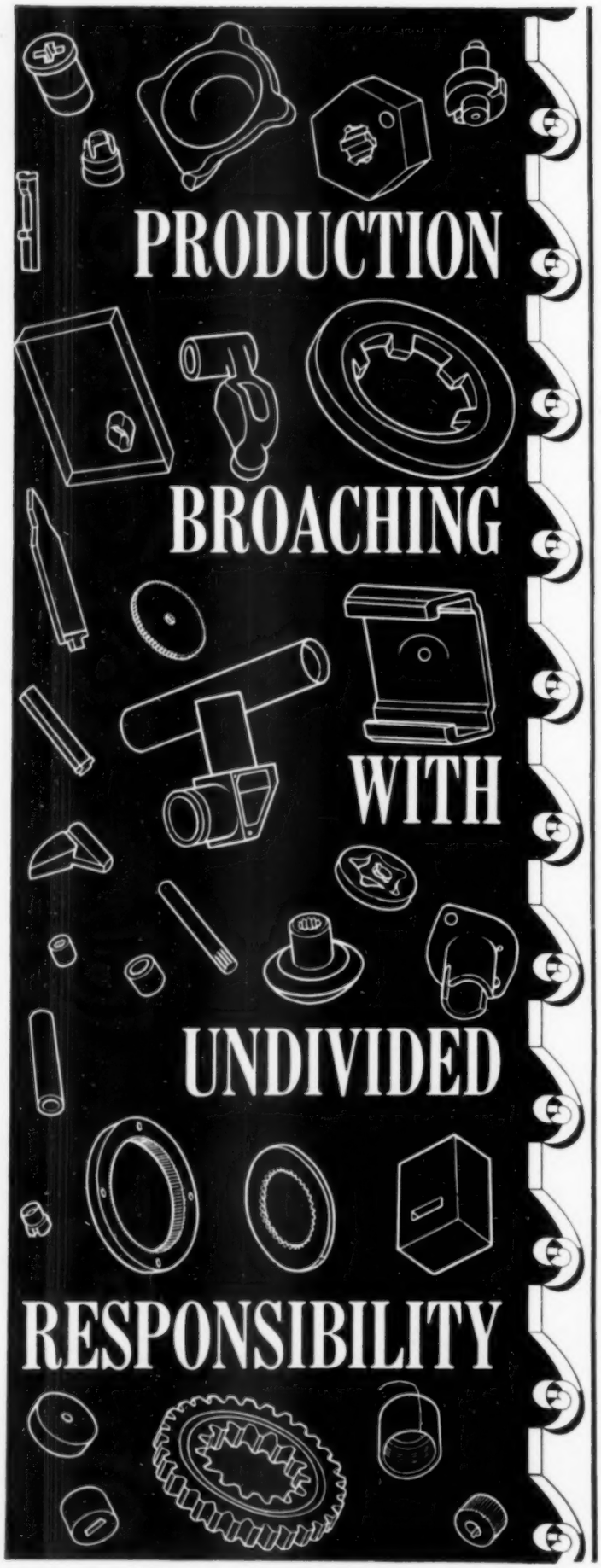

THE largest plant of its kind in the world is ready now. Michigan has a new and completely equipped plant for *diversified commercial Broaching.* When BROACHING is indicated in your postwar "Processing" don't substitute costly machining methods.

If you don't have equipment.
If your equipment is filled up.
If in a hurry to get started.
If you have complicated jobs.
If runs are too short to tool up.

Let MICHIGAN engineer the job — design and build the tools — broach the part — and do it all with UNDIVIDED RESPONSIBILITY.

WE DESIGN — BUILD — RECONDITION AND USE BROACHES

We design and build every type and size of broaches—broaching fixtures—involute gages (plug and ring) arbors —holders and pullers for broaching.

Michigan specializes in broach reconditioning and resharpening

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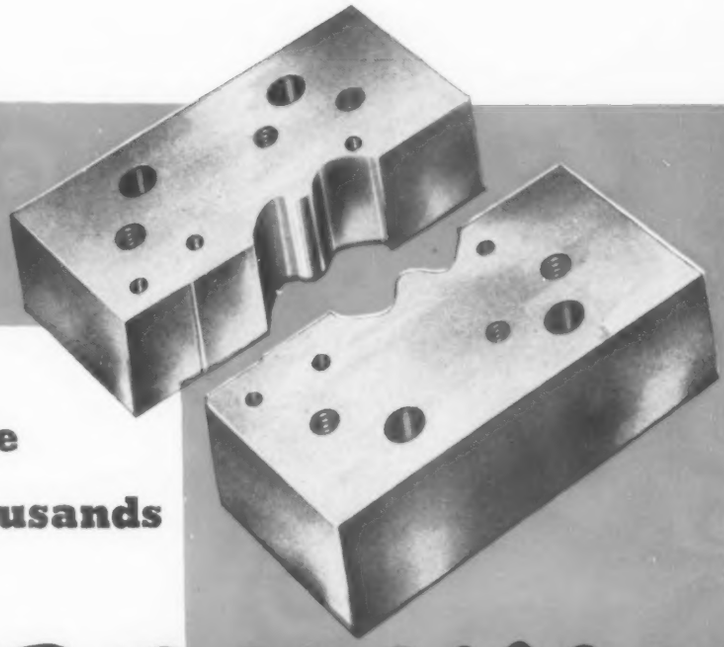
BROACHING SIMPLIFIED

Production Broaching Division

MICHIGAN BROACH COMPANY

10371 NORTHLAWN AVENUE
DETROIT 4, MICHIGAN

For complete information on Production Broaching, send your parts prints and production requirements to Department TE, Michigan Broach Company.

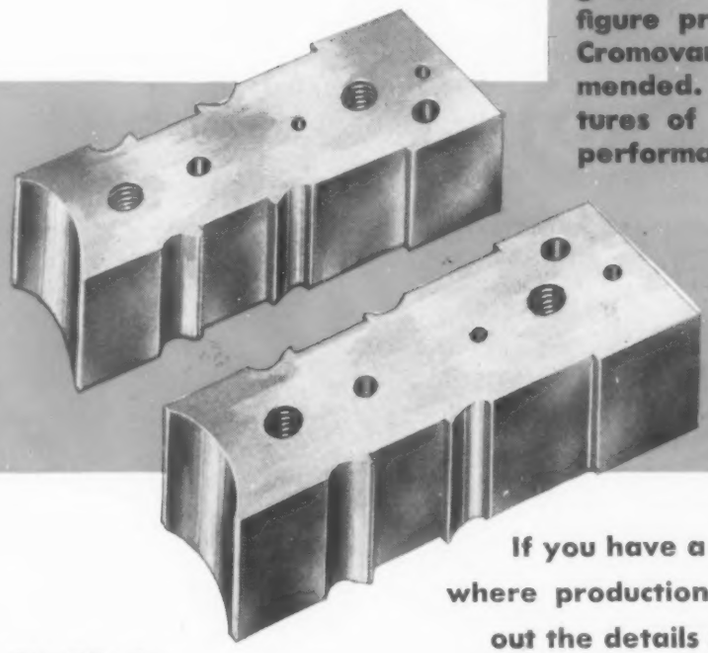


If it's to be hundreds of thousands

use CROMOVAN STEEL DIES . . .

Where it is advantageous to have dies that will assure big figure production and extra long life, Cromovan Triple Die Steel is recommended. The following outstanding features of Cromovan dies are proved in performance histories:

- **minimum dimensional change during hardening**
- **intense hardness from air cooling or oil-quenching**
- **unusual depth of hardness**
- **high resistance to abrasion**
- **good machinability**



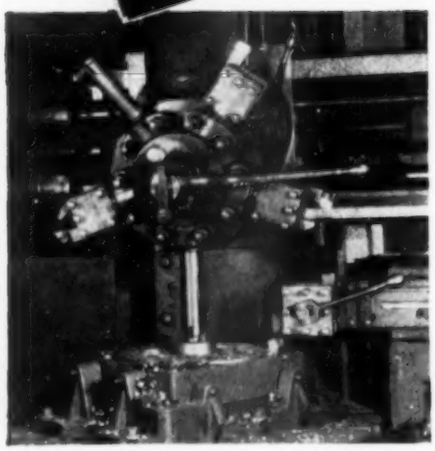
If you have a cutting or forming operation where production requirements are unusual—find out the details about Cromovan's possibilities.

Call in Firth-Sterling STEEL COMPANY

OFFICES: McKEESPORT, PA. • NEW YORK • HARTFORD • PHILADELPHIA • PITTSBURGH • CLEVELAND • DAYTON • DETROIT • CHICAGO • LOS ANGELES

TAKE FULL ADVANTAGE OF YOUR MACHINE'S *Ability!*

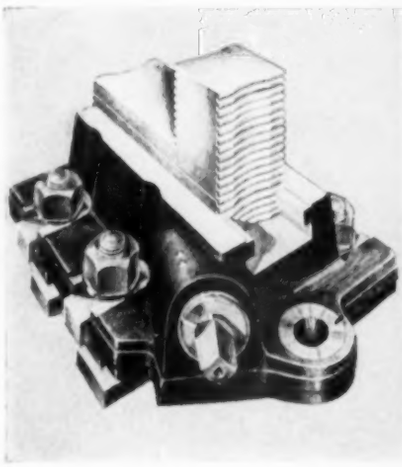
Send FOR THIS *FREE* CATALOGUE..JUST WRITE ON YOUR COMPANY STATIONERY

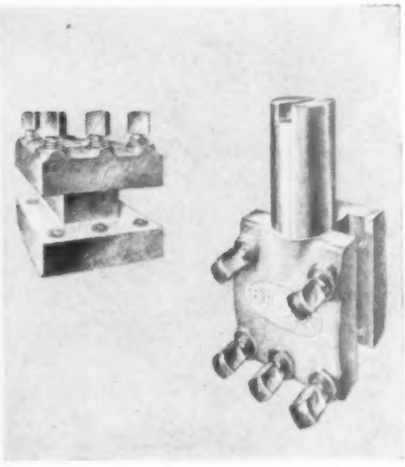


A machine's ability to perform is basically in the machine itself, but no matter how good the machine, it may be hampered by lack of good tools.

Balanced equipment is a valuable asset. Bullard general purpose Standard Tool Equipment for Vertical Turret Lathes is designed for maximum performance. Rugged and quickly applicable to the machine, these tools lower the cost of "change-over" and "set-up." Properly set on the machine they provide a sequence of operations which cuts time between cuts, as well as on cuts.

For your old Bullard Vertical Turret Lathes or your new machines, use Bullard Standard Tools. Ask for catalog RM-STC 7-12-44. This book should give you some profitable tooling ideas.





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"Manufacturers of Machine Tools"

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VERSATILITY that *Exactly* meets your needs in MACHINE TOOLS

Machine tool design is set free from a host of limitations when Vickers Hydraulic Controls and Drives are used. With no difficulty at all, the designer has an extremely wide choice of feed rates, traverse rates, RPM, sequence of motions, accelerations or decelerations, and thrusts.

Practically any machine tool can be designed *and built* to do *exactly* the required job by using Vickers Hydromotive Controls in one of the infinite number of combinations provided by more than 5000 standard Vickers Units.

In addition, positive overload limitations can be built into any machine—definite safety factors provided for both the machine and the operator.

Only Vickers Hydraulic Controls provide *all* the advantages of hydraulic operation—including exceptional compactness and reliability.

Let Vickers Application Engineers consult with you on your new designs.

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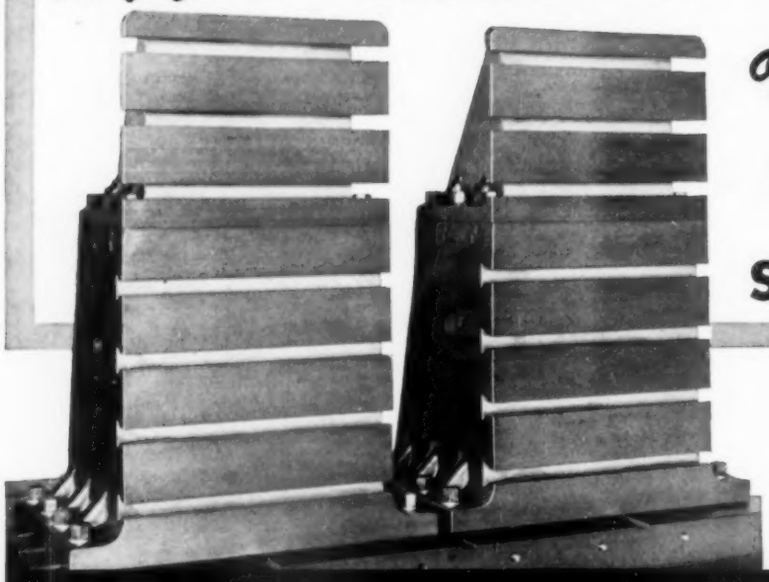
VICKERS Hydraulic CONTROLS and DRIVES

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

A *New* HIGH IN A COMBINATION of MATCHED *Angle* STRUCTURES!

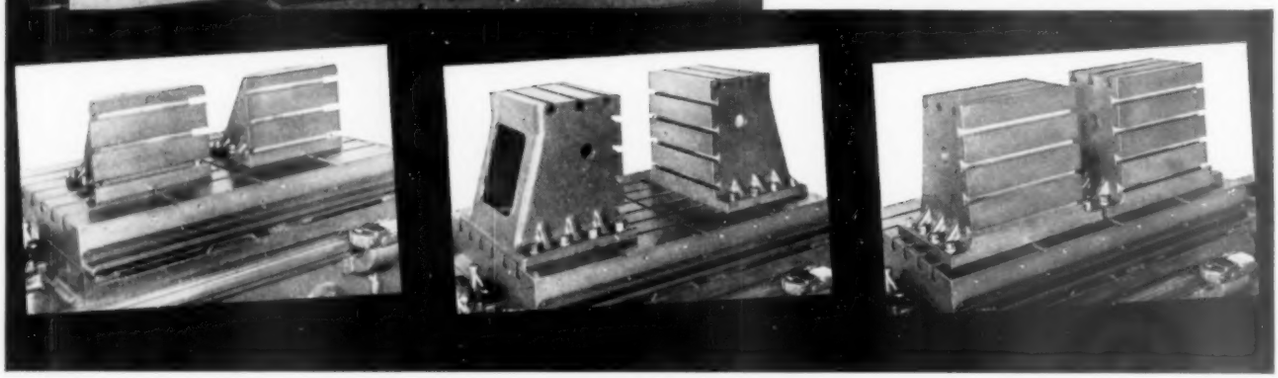


TOP MEMBERS—Vertical Face—12" High, 16" Wide—3 Tee Slots.

BOTTOM MEMBERS—Vertical Face—18¼" High, 16" Wide—4 Tee Slots.

TOP FACE—12" Deep, 16" Wide—3 Tee Slots.

TEE SLOTS—13/16" Wide, 4" Centers.



THIS combination of matched units serves convenience and rigidity for accurately locating and chucking work when boring, milling, planing or for other toolroom and general use. They can be used singly or in variety of combinations for large or small work.

They are machined from box section castings, with Tee slots and flat surfaces in precise alignment.

They are made with the same tooling and quality as the JIGMIL table.

Each set includes Tee slot nuts, studs and screws.

Write for price and delivery!

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World's finest boring and milling machine

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PRICED AS LOW AS 7¢ PER BLANK

Carboloy Standard Blanks include: 5 styles for "universal" use; 3 styles for reamers, scrapers (and centers)—in all the commonly used sizes and grades for machining all metals.

For 60-80% of all your carbide machining needs, you'll find Standard Carboloy Blanks tops in economy—flexibility—convenience. Here's why they rate so high in these important features—

1. *Low Price:* More than 50% of all general purpose Standard Carboloy Blanks range in price from 60 cents down to as little as 7 cents each!

2. *"Universal" Application:* Standard Blanks are designed for broad use throughout your range of machining requirements. With only a small, low-cost inventory in your crib, you're still prepared for quick tool-up on the average job.

3. *Stocked for Prompt Delivery:* Standard Blanks are stocked for quick delivery by Carboloy Company, and authorized distributors in 45 cities, coast to coast. Packaged in standard quantities, for your convenience.

Available in a wide range of sizes; in grades for cutting steel, cast-iron, non-ferrous metals and non-metallics. Write for FREE catalog GT-175R.

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is available from the mills listed below. Each brand name represents a steel that is made according to a genuine MO-MAX formula.

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ATLAS STEELS, LIMITED . . . . . "MOHICAN"
BETHLEHEM STEEL COMPANY . . . . . "BETHLEHEM HM"
BRAEBURN ALLOY STEEL CORPORATION . "MO-CUT"
CARPENTER STEEL COMPANY . . . . . "STAR MAX"
COLUMBIA TOOL STEEL COMPANY . . "MOLITE M-1"
CRUCIBLE STEEL CO. OF AMERICA . . "REX T-MO"
HENRY DISSTON & SONS, INC. . . . . "DI-MOL"
FIRTH-STERLING STEEL COMPANY . . . "HI-MO"
HALCOMB STEEL COMPANY . . . . . "REX T-MO"
JESSOP STEEL COMPANY . . . . . "MOGUL"
LATROBE ELECTRIC STEEL COMPANY . . . . "TATMO"
ST. LAWRENCE ALLOYS, INC. . . . . .
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VANADIUM-ALLOYS STEEL COMPANY . . . "8-N-2"
VULCAN CRUCIBLE STEEL COMPANY . . . . "VUL-MO"

FOR THE FULL STORY ON MO-MAX high speed steels—their physical properties, their advantages, and how to heat treat them—write today for the new, revised MO-MAX Handbook.

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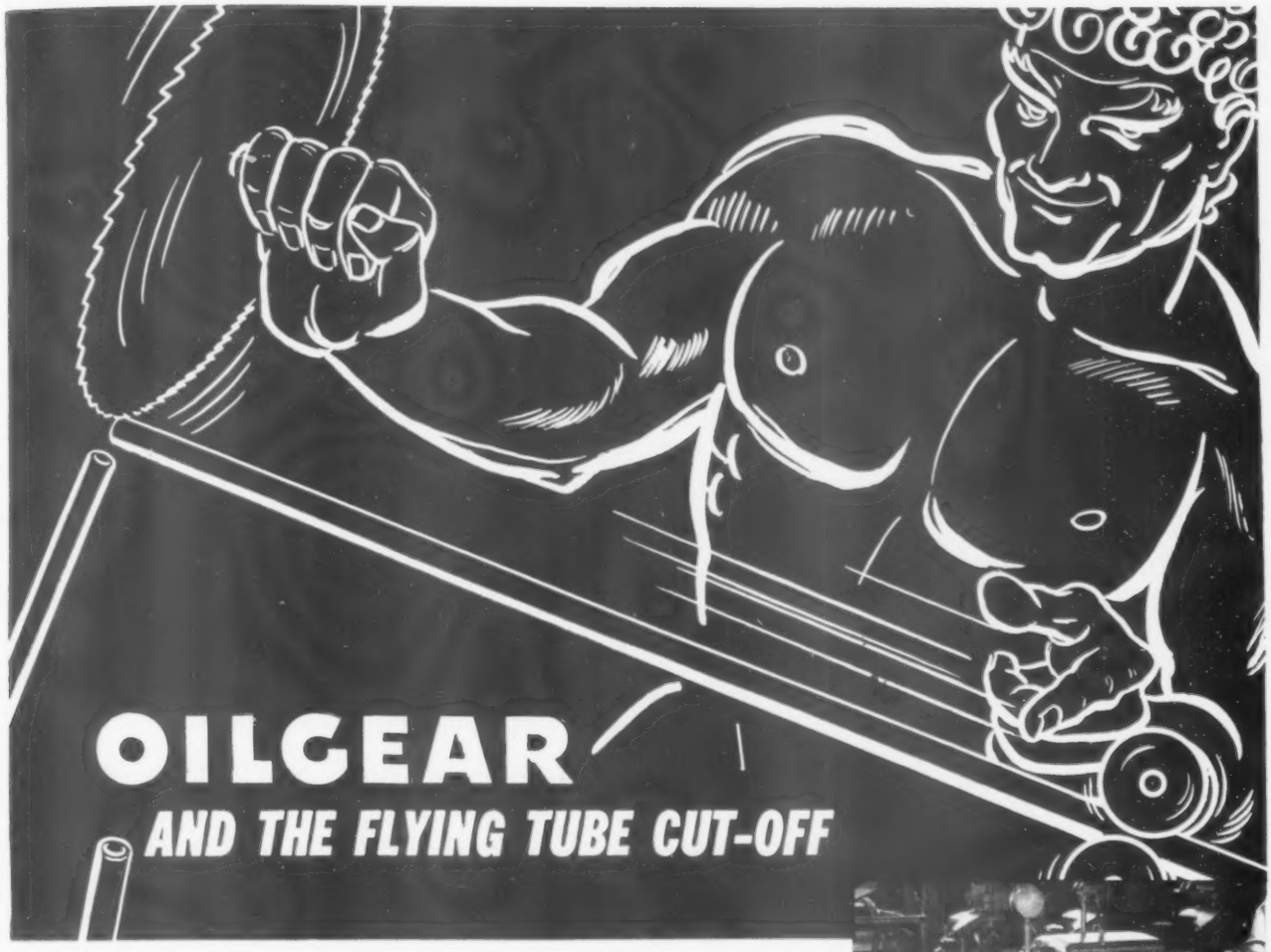
THE CLEVELAND TWIST DRILL COMPANY • 1242 East 49th Street • Cleveland 14, Ohio



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AND THE FLYING TUBE CUT-OFF

How multiple high velocity motions are kept in step with a continuous manufacturing process

Thanks to Oilgear Fluid Power, all the following functions are performed simultaneously with a continuous tube-forming, -welding and -straightening process.

Three thousand pounds of carriage are quickly and smoothly accelerated in step with the advancing tube—which must never be stretched or compressed!—moving at a speed anywhere between 30 to 100 feet a minute.

Then a second, smaller carriage hurries in the opposite direction to measure off the length of tube to be cut—16 to 45 feet plus or minus 1/32"—; reverses instantaneously into step with tube speed, clamps the tube and glides with it during the cut-off.

The rotary cut-off slices through the tube which never abates its movement. The cut-off tool retreats, the auxiliary carriage unclamps the tube, and both auxiliary and main carriages race back to their original position ready for a new operation on the relentlessly advancing tube.

Smooth acceleration of heavy masses; smooth, high velocity, long linear motion; smooth, rapid deceleration and reversal; wide range of speed; positive synchronization and flexibility and control: these are only a few of the features that recommend Oilgear Fluid Power to you. Get the whole story without fail and without delay by writing today. THE OILGEAR COMPANY, 1308 West Bruce Street, Milwaukee 4, Wisconsin.

One of two Oilgear Fluid Power generators that make the flying cut-off lock step with forming, welding and straightening units in the continuous tube process.

ARE YOU TRYING TO:

1. Apply large forces through long . . . or short . . . strokes at variable speeds? **2.** Obtain automatic work cycles, variable speeds in either direction . . . . . with or without preset time dwell? **3.** Apply large forces through continuous or intermittent reciprocating cycles at constant or variable velocities? **4.** Obtain extremely accurate control of either position or speed of a reciprocating member? **5.** Apply accurately variable pressure either static or in motion? **6.** Closely synchronize various motions, operations or functions? **7.** Apply light . . . or heavy . . . forces at extremely high velocities through either long or short distances of travel? **8.** Obtain continuous automatic reversing drives at constant R.P.M. or over a wide range of speed variation? **9.** Obtain accurate remote control of speed and direction of rotation, rates of acceleration and/or deceleration? **10.** Obtain constant horsepower output through all or part of a speed range? **11.** Obtain automatic torque control? **12.** Obtain accurately matched speed of various rotating elements? **13.** Obtain constant speed output from a variable speed input? **14.** Obtain full preset automatic control, elimination of problems of shock, vibration, etc.?

You Need Oilgear!

Oilgear Fluid Power

"HERE'S THE TOOL FOR COST-CUTTING PERFORMANCE!"

In minimum spoilage, faster cutting and longer life between sharpenings, Morse Tools help cut production costs with the same efficiency they cut away metal.

MORSE THERE *IS* A DIFFERENCE **TWIST DRILL AND MACHINE COMPANY**
NEW BEDFORD, MASS., U. S. A.

NEW YORK STORE: 130 LAFAYETTE ST. • CHICAGO STORE: 570 WEST RANDOLPH ST. • SAN FRANCISCO STORE: 1180 FOLSOM ST.

When the chips are down!

The Eclipse Multi-Diameter Cutter above core drills, chamfers and spot faces a malleable iron casting. The chips illustrated were taken from the operation.

Do you have our catalog?

SEVERAL operations can be performed with one cutter retaining not only absolute contricity between diameters but chatter-free finish to close limits.

Multi-diameter design for performing combinations of core-drilling, counterboring, chamfering, center cutting, spot facing and deburring was introduced by Eclipse 22 years ago.

When your competitive bid forces production costs down and volume up—*when the chips are down*—call in an Eclipse field man—check on the design that saves on tool costs and man hours yet does the job faster and better.

ECLIPSE COUNTERBORE CO.

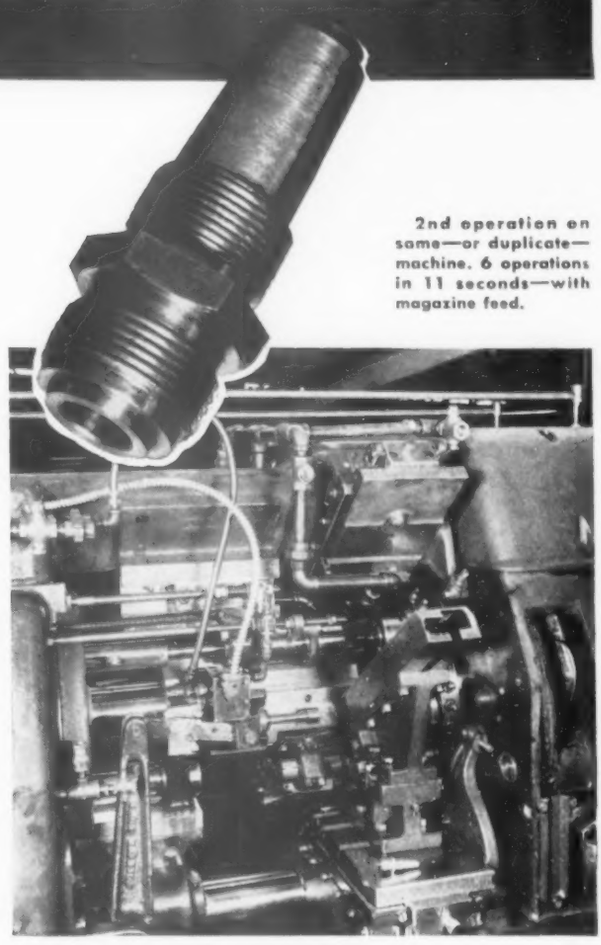
Founded thirty years ago

DETROIT 20, MICHIGAN

Up-to-date example of COST REDUCTION

1st operation on automotive part—turned from bar stock—15 operations in 16 seconds.

Acme-Gridley Bar Automatic—set up from 1st operation.



2nd operation on same—or duplicate—machine. 6 operations in 11 seconds—with magazine feed.

Set up for second operation showing magazine in position.

TIME SAVED = MONEY SAVED

AUTOMATIC loading methods on Acme-Gridley Machines—gravity or conveyor magazines, feeding through rear of spindle and pick-off—introduce new ways to reduce the cost of precision parts, wherever secondary machining is involved.

The Acme-Gridley is truly a universal machine, with quick adaptability to a wide range of work, under conditions of high production and extreme accuracy.

Tell us your production problems—and we will tell you how fast. No obligation.

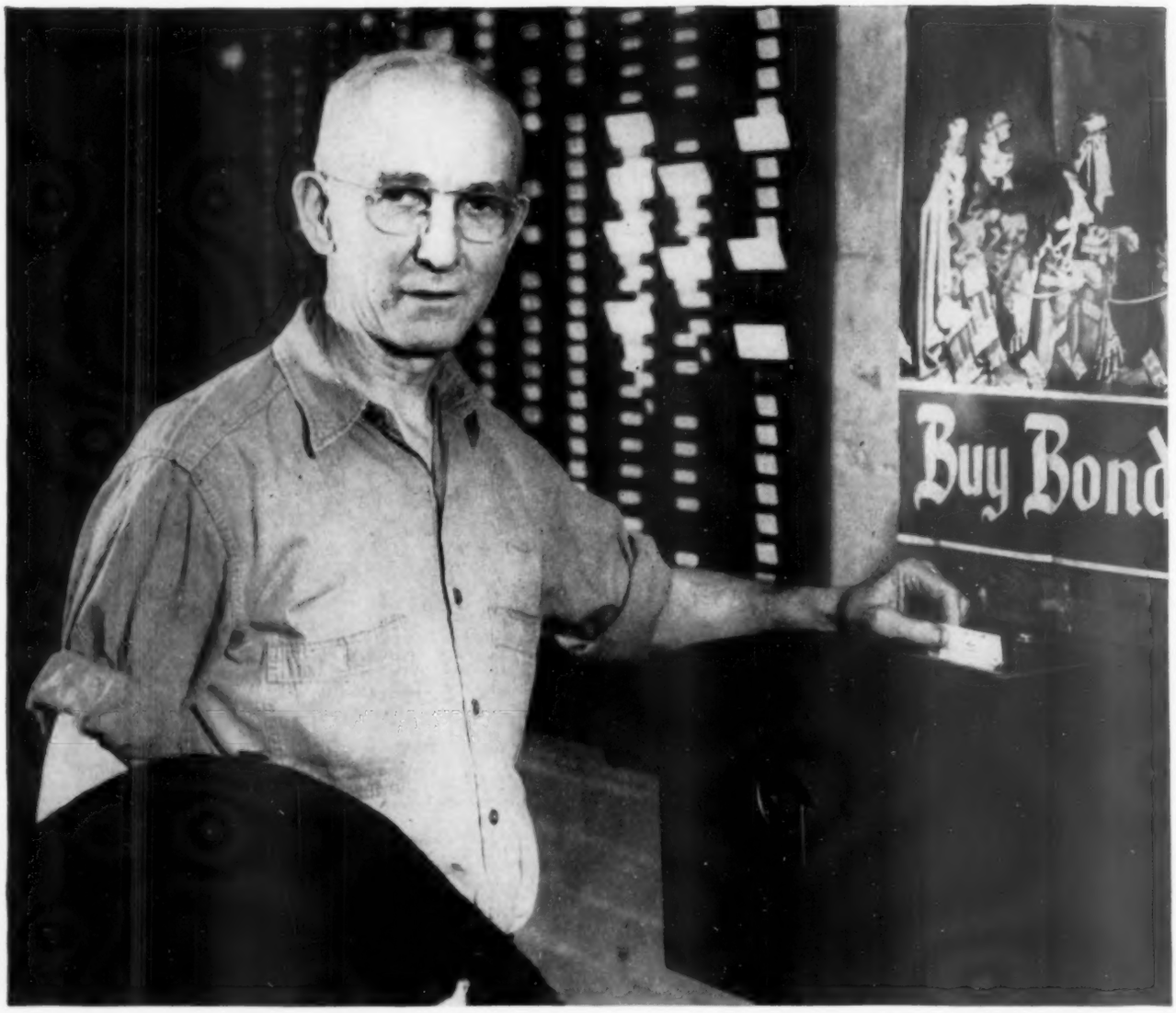
The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

COLLETS AND PUSHERS

The design, materials and methods of processing GENUINE Acme-Gridley Collets and Pushers are vital to continuous low-cost performance on your Multiple Spindle Automatics.

Bulletin CP-45

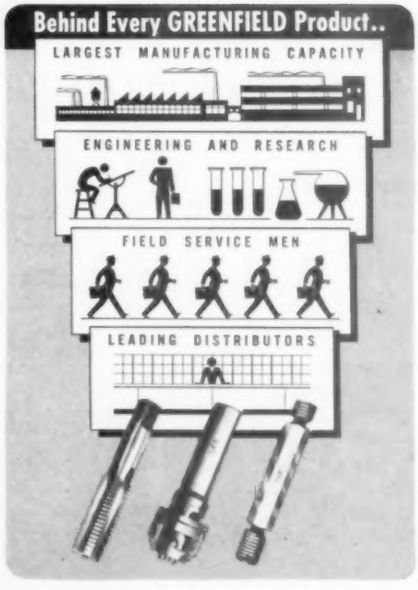


Not 62,940 hours for nothin'!

I figure I've punched in over 62,940 hours for GTD.

Maybe you fellows who buy threading tools don't realize it, but those hours mean something when you buy a tap, die or gage with the GTD mark on it. Those hours mean better workmanship—the result of years of learning by doing.

You might be interested to know that in the "Greenfield" organization there are 296 of us who have spent 20 years or more at our jobs—making high quality threading tools. *When you buy "Greenfield"—you buy precision. And precision takes practice.*



GTD

GREENFIELD

GREENFIELD TAP and DIE CORPORATION

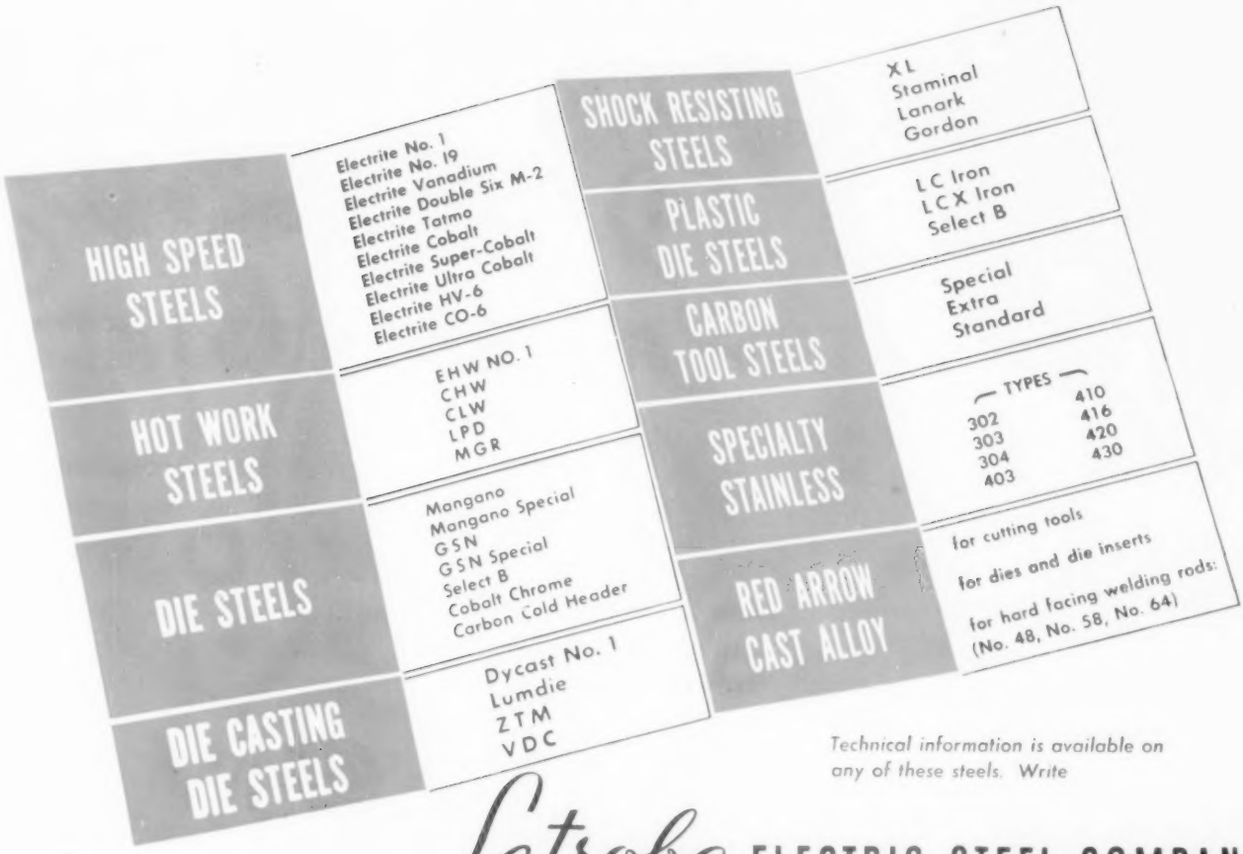
GREENFIELD, MASSACHUSETTS

1946

...and a good time to meet the entire family of

LATROBE

tool and die steels



Technical information is available on any of these steels. Write

Latrobe ELECTRIC STEEL COMPANY

MAIN OFFICES *and* PLANT •• LATROBE • PENNSYLVANIA

LESCO


TAPS WITH DRILL OR REAMING SECTIONS
LONG TAPS AND SHORT TAPS
TAPS WITH SHORT OR LONG CHAMFER
STEPPED TAPS AND STRAIGHT TAPS
LARGE TAPS AND SMALL TAPS
SPIRAL POINTED OR INTERRUPTED THREAD TAPS
ALL KINDS OF TAPERED TAPS
• GROUND TAPS •
THREAD MILLING CUTTERS •
THREAD GAGES & SPECIAL THREADING TOOLS, MACHINES AND CHECKERS •
You can recondition all these taps ON A DETROIT
TAP RECONDITIONER
Having one of these DETROIT 4 in 1 tap reconditioners in your shop is just like getting an almost unlimited supply of NEW TAPS for next to nothing. With this simple low cost machine you can quickly put your worn taps back in first class condition. The machine will chamfer the taps, grind from 2 to 6 flutes, spiral point them where required and polish the points. Pays for itself in a remarkably short time. Write today for complete descriptive Bulletin #DTR-2.
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TAP & TOOL CO.
8432 BUTLER AVE. • DETROIT 11, MICHIGAN

BAYFLEX...a new Bay State development

THE AMAZINGLY SAFER CUT-OFF WHEEL

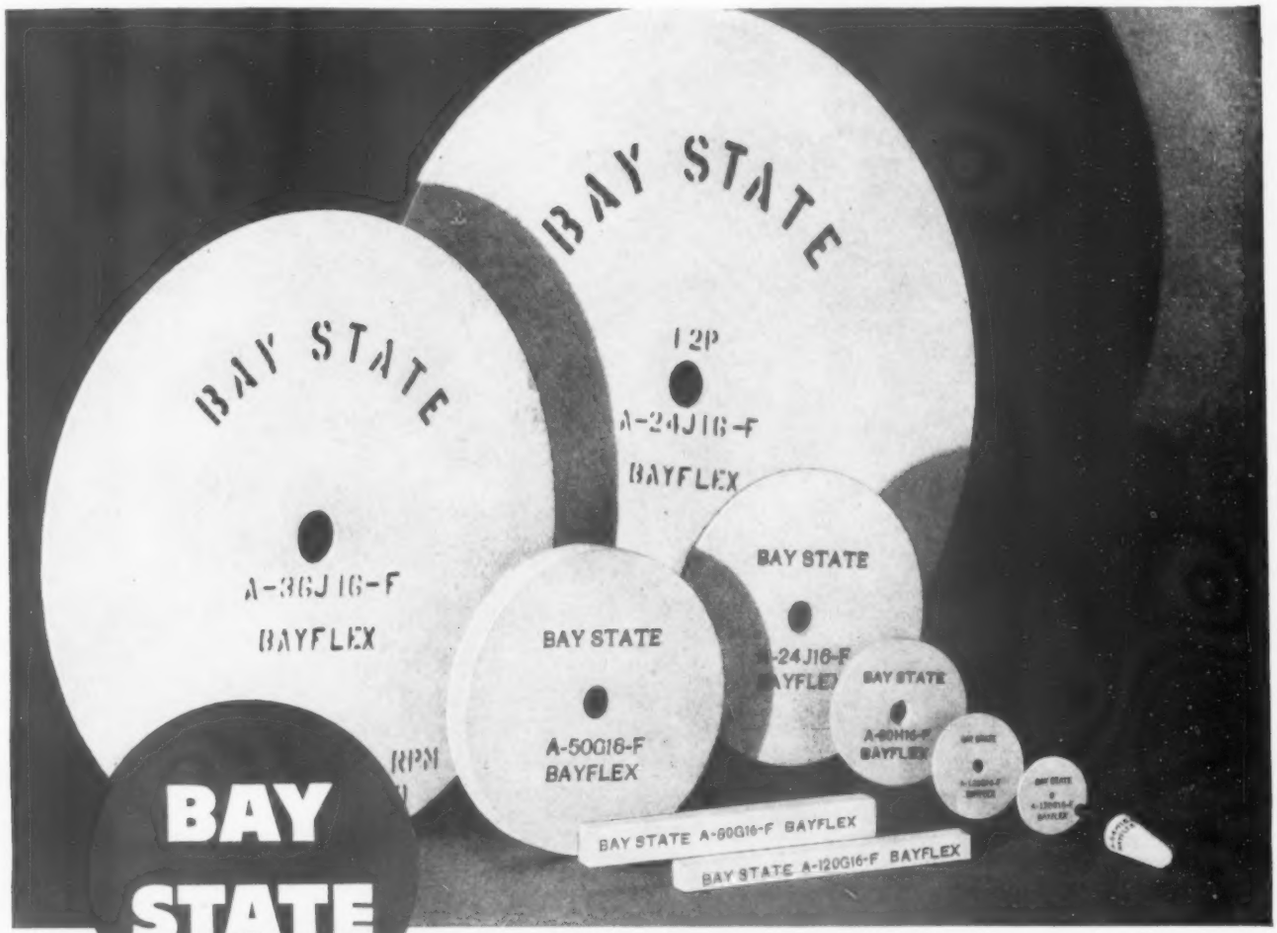
The New Bayflex Wheels, incorporating cotton fibres in abrasive bonding, are Bay State's answer to the demand for cut-off wheels that combine *greater safety* with *faster, freer* cutting action and minimize the operator's fear of wheel breakage.

Greater safety results from the increased toughness and balanced flexibility of an entirely new bonding material. And in addition to providing fast cutting, this balanced flexibility permits side grinding and close following of contours with the danger of wheel breakage greatly reduced — an amazingly safer wheel.

Already, in many foundries and other metalworking plants, these advanced wheels are setting new performance records in cutting-off non-ferrous metals. Write for recommendations on how the new safe-operating, time-saving Bayflex Wheels can benefit *your* production.

BAY STATE ABRASIVE PRODUCTS CO.

9 Union Street, Westboro, Mass.



BAY STATE ABRASIVE PRODUCTS

Top Performance Consistently Duplicated

GRINDING WHEELS · HONING AND SUPERFINISHING STONES · PORTABLE SNAGGING WHEELS
MOUNTED WHEELS AND POINTS · CUT-OFF WHEELS · INSERTED-NUT DISCS · AND CYLINDERS

We'll lift the covers . . . IN MARCH

In this space, in March, we'll disclose three amazing new turning machines which Monarch has engineered expressly to meet rising production costs. However, if you'd like a quick "preview", we'll be glad to send you photographs and brief descriptions, immediately, with full details to follow the formal introduction. Write Dept. 212.

THE MONARCH MACHINE TOOL COMPANY · SIDNEY, OHIO

ACCURACY · ECONOMY · LONG LIFE

Monarch
TURNING MACHINES

THIS POPE SEALED MOTORIZED SPINDLE BELONGS ON *Your* 6" x 18" SURFACE GRINDERS

Its full 1 HP G-E motor is sealed-in. It runs at top efficiency, without attention. Dust, dirt, nuts, bolts and fingers are sealed out. Its extra large SKF Super-Precision, Double Row roller bearings and the thrust bearings are sealed in, too. No lubrication to worry about.

These exclusive features, combined with Pope precision craftsmanship, result in a spindle that will rough off surplus metal fast and then produce a superior finish.

Every 6" x 18" surface grinder needs to be equipped with this Pope Sealed-in Motor, Sealed-in Lubrication Unit

FOR FINER FINISHES AND PEAK PRODUCTION

Order one of these spindles and see for yourself.

Send us the name of your 6" x 18" Surface grinders and we will be glad to send you quotations.

No. 30

POPE

POPE MACHINERY CORPORATION
ESTABLISHED 1926
261 RIVER STREET • HAVERHILL, MASSACHUSETTS
BUILDERS OF PRECISION SPINDLES

POPE

Talide
(TUNGSTEN CARBIDE)
Performance!

TALIDE METAL MEETS EVERY REQUIREMENT

"98% More Production per Tool Grind with Talide Tools"

The chief engineer of a prominent manufacturer recently compared performance on different carbide cutting tools on a non-ferrous aircraft part. He reports . . .

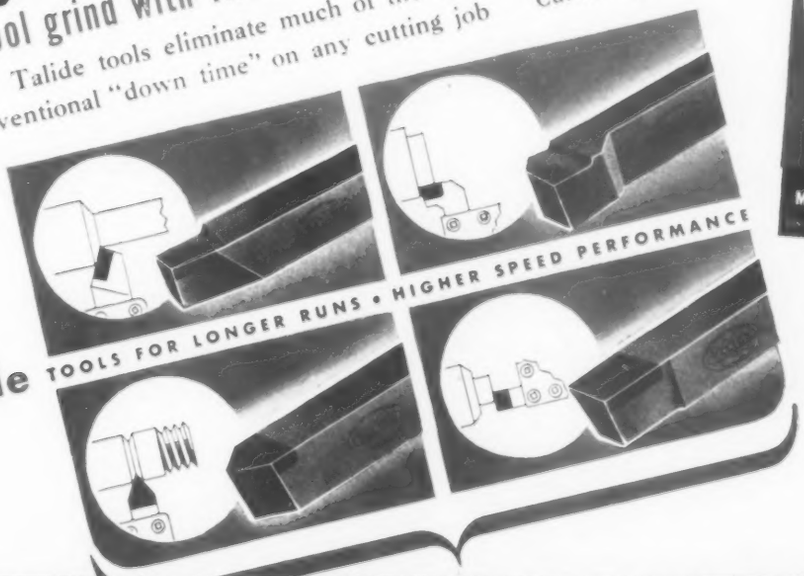
"98% More production per tool grind with TALIDE"

Talide tools eliminate much of the conventional "down time" on any cutting job —turning, boring, or facing. They keep cutting on and on and on.

Universally used for cutting operations on steel, cast iron and non-ferrous metals and non-metallic materials, Talide Tools are guaranteed to slice production costs.

You can obtain Talide tool tips direct from stock or a Talide sales engineer will call and recommend the proper use and grade of Talide Carbides for you.

Send for Catalog 44-T listing standard Talide Tools and Tips.



Talide TOOLS FOR LONGER RUNS • HIGHER SPEED PERFORMANCE

THE ENGINEERED CARBIDE FOR ALL APPLICATIONS

METAL CARBIDES CORPORATION

YOUNGSTOWN 5, OHIO *Pioneers in Tungsten Carbide Metallurgy*

SINTERED CARBIDES FOR CUTTING • HOT PRESSED CARBIDES FOR DRAWING AND WEAR RESISTANCE

● The widespread use of triple-alloy steels containing Nickel, chromium and molybdenum is based on extensive experience in widely divergent engineering fields.

It has been found that they can be counted on for consistent performance. The depth to which full hardness is developed is comparable to that attained by other alloy steels. Their response to heat treatment is dependably uniform.

Moreover, the wide range of compositions available, makes it possible to select *accurately* suitable alloy steels for a broad range of applications.

Inquiries regarding the selection and uses of triple-alloy steels containing Nickel are invited.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 Wall Street New York 5, N. Y.

Our 3 POINT POLICY

Insures Lower Production Costs for YOU

QUALITY *Precision Built*

DIES · FIXTURES · JIGS · GAGES *are*

1. *Engineered for maximum production capacity*
2. *Built Right*
3. *Priced Right*

Our customers like this 3 Point Policy. It keeps production costs down—helps keep them "in line." ★ Every tool we design and build must measure up to this yardstick. If you need tools to get work out F-A-S-T and without interruption, drop us a line TODAY!

QUALITY TOOL & DIE CO.

Manufacturers of "Quality" Products

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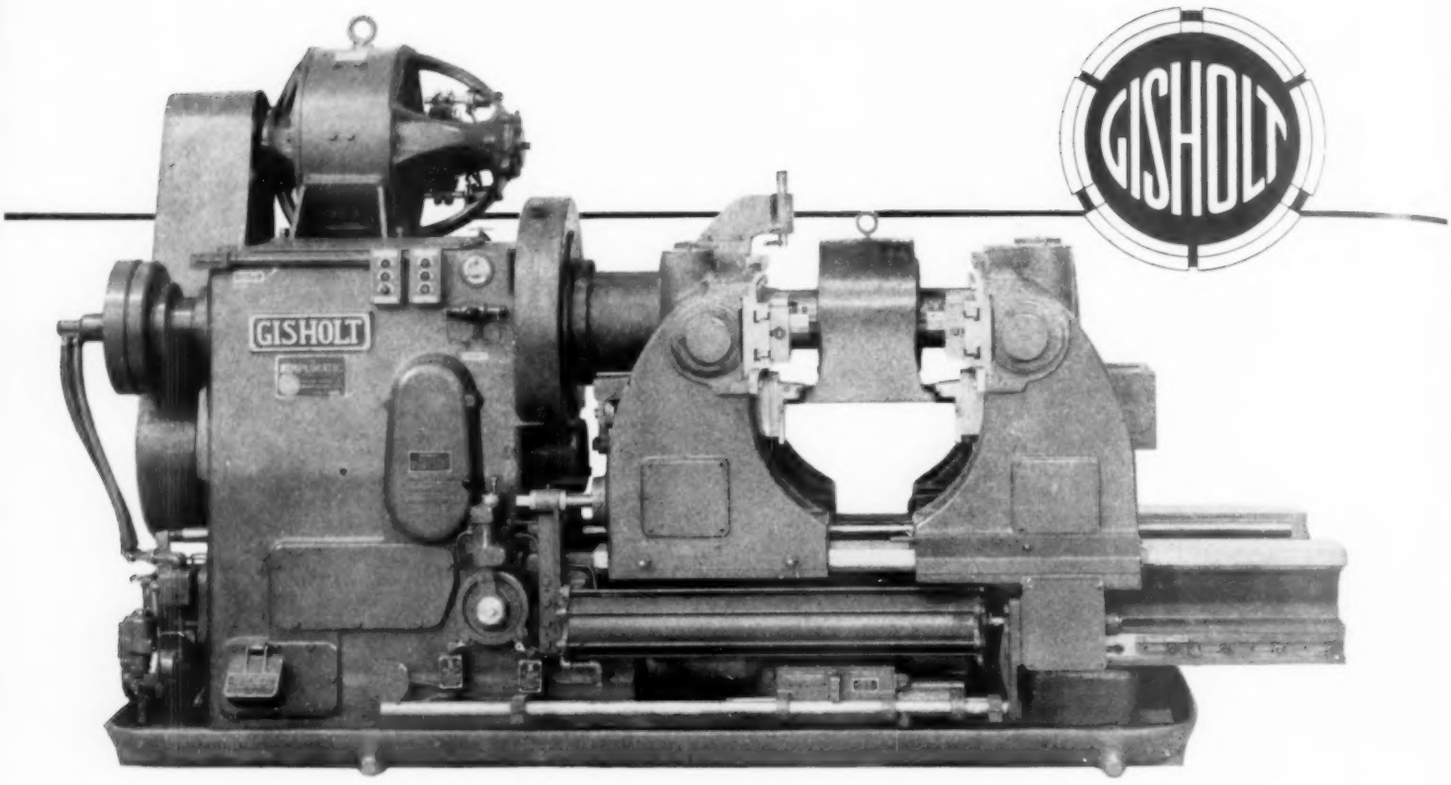


Motor frames machined – both ends – three minutes – ORLESS

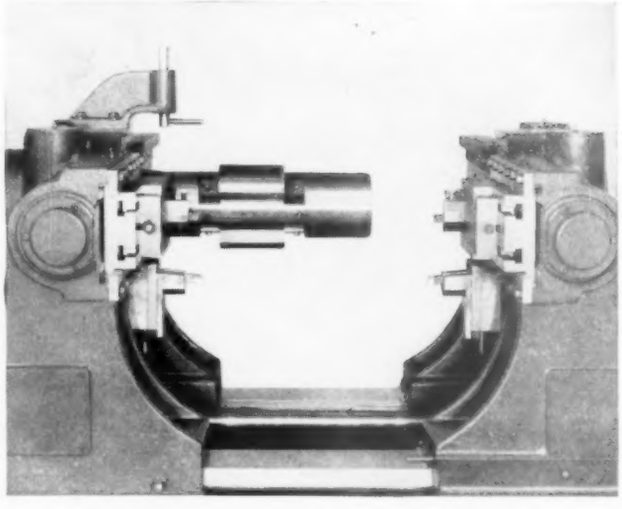
Here's another example of the way this versatile automatic lathe can be adapted to handle an extremely wide range of work.

THE GISHOLT SIMPLIMATIC

Equipped with two special vertical carriages, this Gisholt Simplimatic is set up to machine both ends of these motor frames at once.

Finish facing and boring operations are made possible at both ends simultaneously by the flexible arrangement of front and rear slides. Work is carried on an expanding arbor with pilot. Allowing two minutes for loading and unloading, the longest floor to floor time on any of three different sizes of frames is three minutes. Actual machining time is one minute or less.

If you produce standard parts in sufficient volume to consider the economy of automatic machining, look into the Gisholt Simplimatic. It is available in both Platen and Radial types. Write for full information.



This tool arrangement permits still another pair of slides to be mounted at the rear of the vertical carriages. Front slides can then be used for rough facing and rough boring with a shaving cut, rear slides for finish facing, and lower slides (feeding longitudinally) for finish boring.

GISHOLT MACHINE COMPANY

1257 E. Washington Ave. • Madison 3, Wisconsin

Look Ahead . . . Keep Ahead . . .
With Gisholt Improvements in Metal Turning

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

Inside Story

OF A PRECISION HYDRAULIC CYLINDER

This cylinder is 6 x 10 inches, with cushion on head end.

Every Hannifin hydraulic cylinder has these features of improved design and precision construction that promise easier and simpler application, long life without maintenance, and maximum utilization of hydraulic power.

No tie rods. This construction is simpler and stronger, and allows removal of an end cap without collapse of other parts.

Universal end caps. Either end cap can be positioned independently, for convenience in mounting and for simple piping.

Air Vents. Each end cap has air vent plugs on three sides.

Bored and honed bodies. All Hannifin cylinder bodies are bored and honed to exact size. This not only means a cylinder interior that is straight, round, and smooth; but one in which piston assemblies are interchangeable. If a replacement piston is ever needed it can be furnished, and will fit perfectly.

Minimum Fluid Slip. Remarkably low fluid leakage past the piston is assured by exact bores and close tolerances on the piston, plus the use of precision rings.

Maximum power. Precision cylinder bodies and piston ring seal provide for consistent high efficiency operation with maximum usable power.

All types and sizes. Seven standard mounting types are available in a full range of sizes 1 to 6 inch bore, for working pressures up to 1500 lbs. sq. in. Models are available with or without adjustable cushions, and with small diameter piston rod, 2 to 1 differential piston rod, or double end rod.

Many special mountings and large size cylinders are also available, built to order. Write for bulletin 35 giving complete specifications.

HANNIFIN MANUFACTURING CO.

621-631 South Kolmar Avenue • Chicago 24, Illinois

Hannifin

HYDRAULIC CYLINDERS

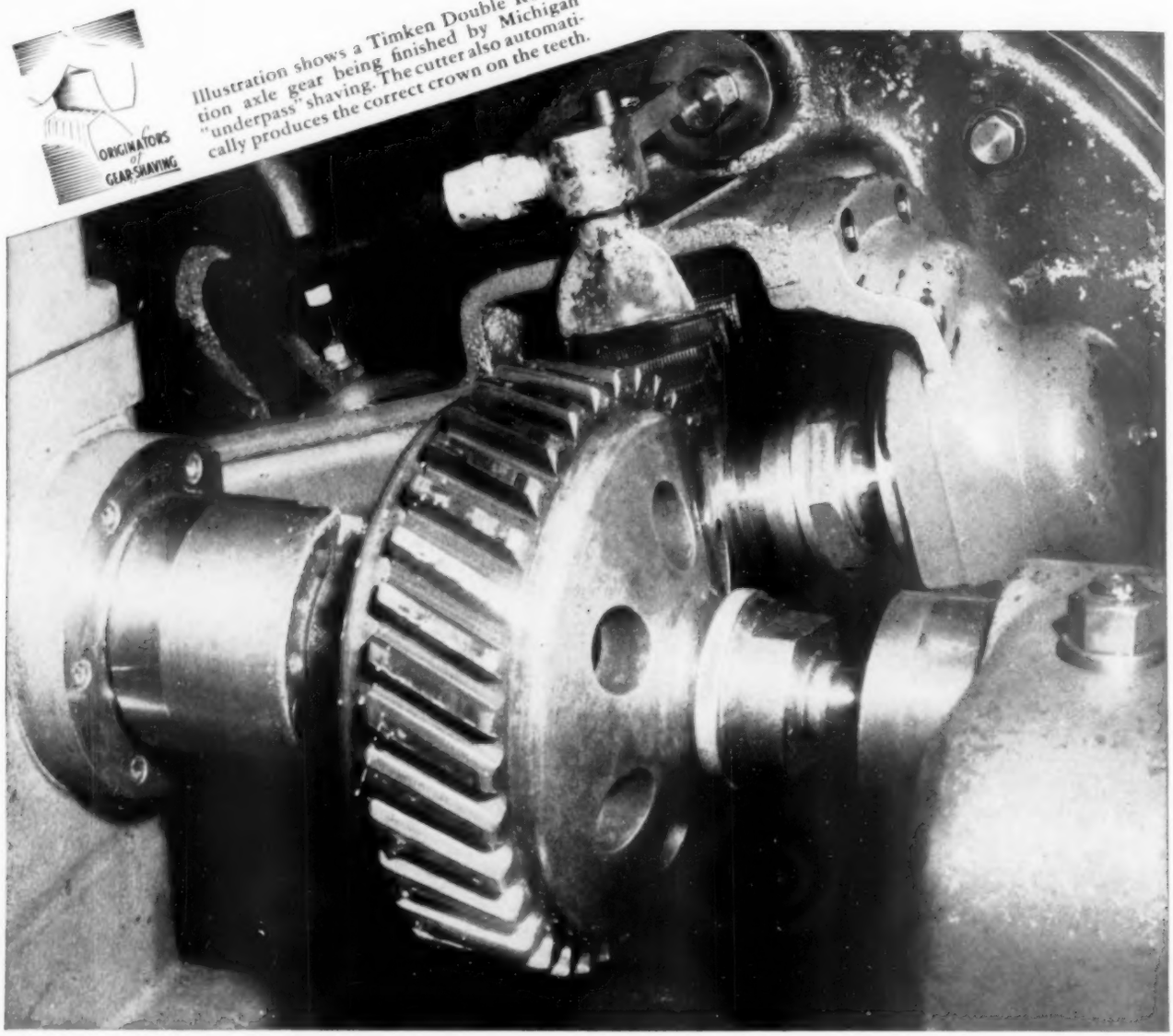


Illustration shows a Timken Double Reduction axle gear being finished by Michigan "underpass" shaving. The cutter also automatically produces the correct crown on the teeth.

Underpass Curve Shaving Boosts Gear Production 33⅓%

Sure, any kind of gear shaving is fast, but . . .

According to Wisconsin Axle Division, this Michigan 862 rotary gear finisher is producing 33⅓% more—and more uniform—gears (3½" to 16½" pitch diameters) with longer cutter life by the use of "underpass" shaving. In addition, where required, the gears are correctly curve-shaved *by the shaving cutter* at either end of the teeth.

"Underpass" shaving—exclusive on Michigan gear finishing machines—is the fastest method of producing the most accurate gears possible. In many cases a single cycle of the cutter—forward and back—is sufficient to finish a gear.

"Underpass" shaving is used interchangeably for both spur and helical gears. It is equally applicable to large as well as small gears—from ¼" to many feet in diameter.

For further information on Michigan gear finishing machines to fit your requirements, ask for "Underpass Machine Bulletins."

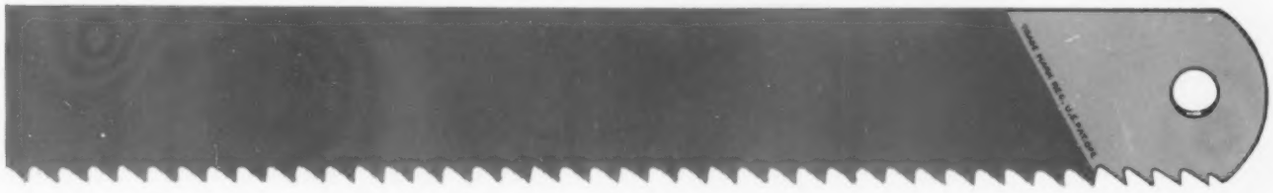
MICHIGAN TOOL COMPANY

7171 E. McNICHOLS ROAD DETROIT 12, U. S. A.

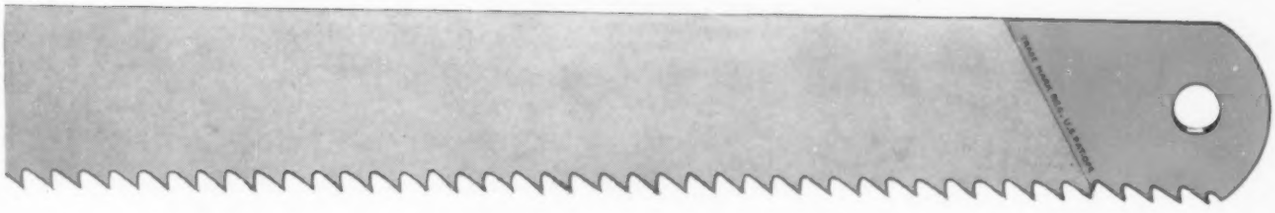
Get SIMONDS

"RED END" HACKSAW BLADES

. . . AND GET A LONGER RUN



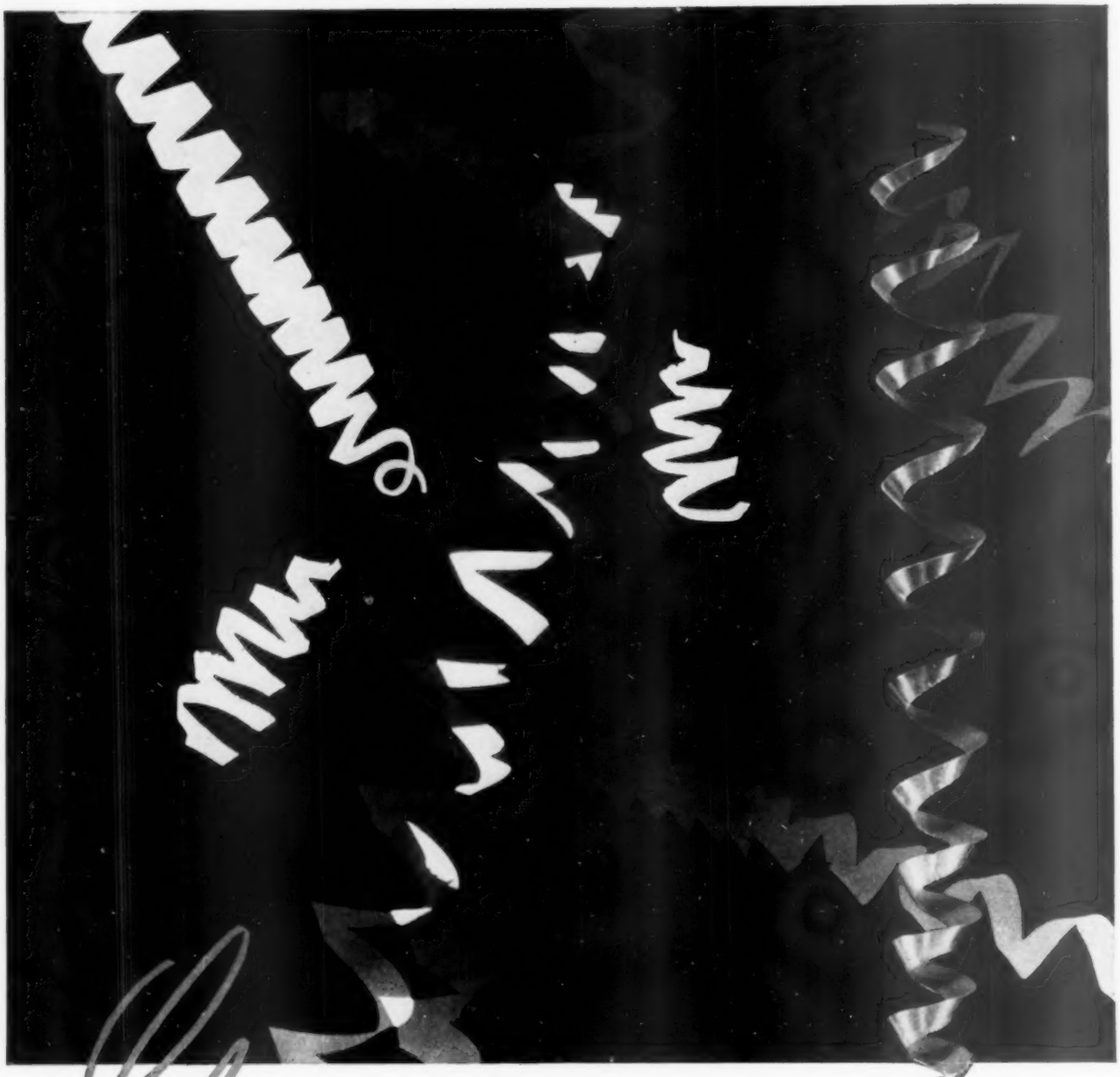
FOR YOUR MONEY



SEE SIMONDS SOUND-FILM, in color, showing how to get the best results and longest service out of the finest blades made . . . SIMONDS "Red End" Blades for Hand and Power Hacksawing. You can arrange with your Industrial Supply Distributor for a showing of this interesting movie. Or write to the nearest Simonds office.

SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASS.

BRANCH OFFICES: 1350 Columbia Road, Boston 27, Mass.; 127 S. Green St., Chicago 7, Ill.; 416 W. Eighth St., Los Angeles 14, Calif.; 228 First St., San Francisco 5, Calif.; 311 S. W. First Ave., Portland 4, Ore.; 31 W. Trent Ave., Spokane 8, Wash. *Canadian Factory:* 595 St. Remi St., Montreal 30, Que.



Chips **FROM NEW PARTS**

Olofsson machines and operators at our two big plants are 'pointed up' to do your job just right. Chips or metal scraps are not the result of just whittling away, but rather, the result of planned engineering and skill to produce special machinery, tools, dies, jigs and fixtures for product manufacturing.

OLOFSSON TOOL AND DIE CO., LANSING, MICHIGAN

CHICAGO ENGINEERING OFFICE—600 SOUTH MICHIGAN AVENUE

A Million Precision Gages with DoALL'S "PRODUCTO-CHEK"!

Why, with reconversion, should you maintain bulging cribs of costly gages for production inspection? Such stocks of single-purpose tools are today a thing of the past. Now a million gage jobs can be done with a small kit—DoALL Producto-Chek—the greatest short-cut ever devised to slash costs of production inspection.

Accurate gaging tools are assembled from Producto-Chek in a few moments. When a job is finished, parts are simply replaced in the box—no unusable gages left to write off.

Producto-Chek is used with gage blocks. It gives you lightweight snap gages from one-tenth to 18 inches in size; plug gages of all sizes in steps of .0001 inches; angle and multiple comparators; square checks; bench comparators; internal and external calipers; height gages; pitch and center gages and many other instruments.

Besides providing limitless types, sizes and combinations of gages, Producto-Chek makes gaging operations visual and dependable. Dial indicators show if measurements are "on the head" or "off" and exactly how much—no guesswork in squinting for square check, nor dependence on the "feel" of snap gages.

We want to show you more about Producto-Chek—Why not phone or write for Producto-Chek Circular?

INDUSTRY'S NEW SET OF TOOLS

Contour Sawing · Band Filer · Surface Grinders · Magnetic Chucks and Selectron · Colloidal Oils · Dust Collector · Speedmaster · Band Saws · Band Files · Gage Blocks with Instruments

The DoALL Company Minneapolis 4 Minnesota

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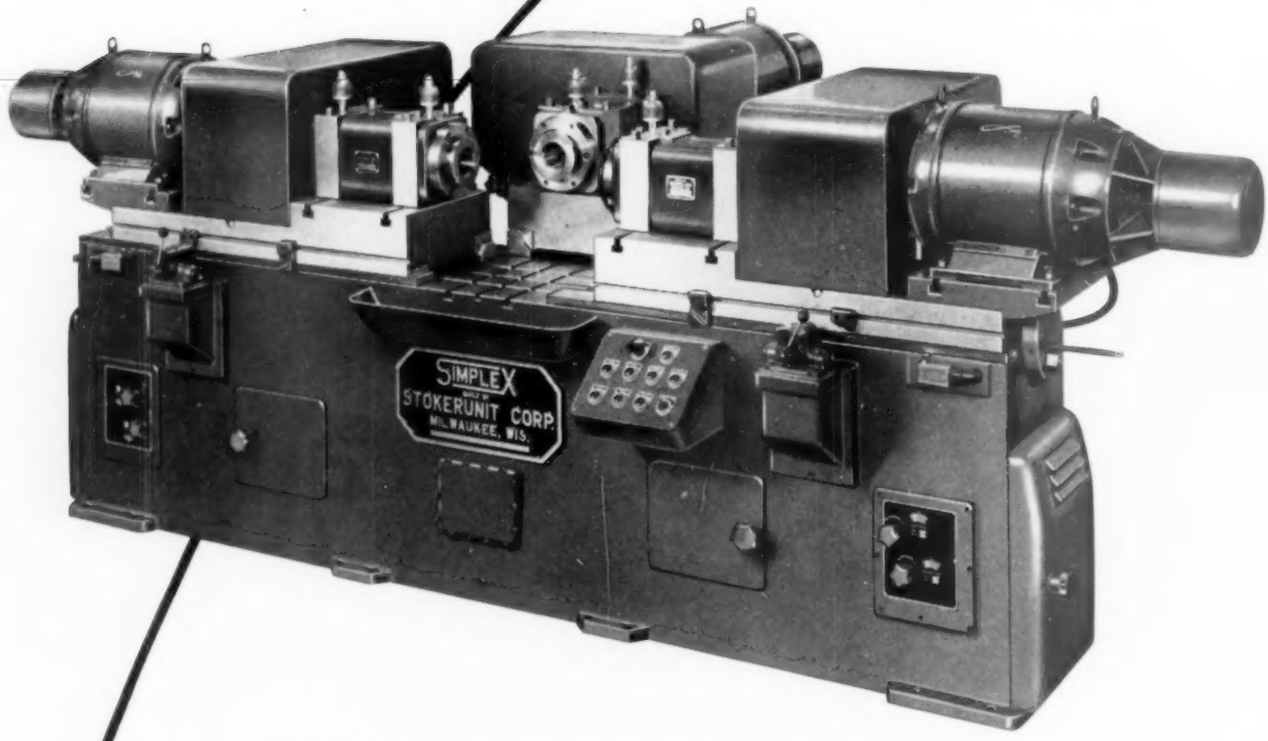
SIMPLEX

NEW METHODS are needed by many manufacturing plants to obtain the high production, close tolerances, and lower labor costs, so vitally necessary to survive in today's competitive markets.

Performing operations from two or more sides simultaneously, with one clamping of a piece in the work holding fixture, is a logical method of attaining these.



SIMPLEX 2U 3-way Precision Boring Machine with unit type heads for boring and facing — adaptable to many jobs — portable electric tools, small gas engines, outboard motor parts, tractor and automotive units, pumps and compressors, and many others in every-day use, with the advantages of simple and rapid change-over from one job to another.

Precision Boring Machines

STOKERUNIT CORPORATION

SIMPLEX Machine Tools Division

4528 West Mitchell Street, Milwaukee 14, Wisconsin

Precision Boring Machines, Planer Type Milling Machines and Special Machine Tools

Proved!

Every Woodworth product must conform to the basic policy of the N. A. Woodworth Company — to produce only the most accurate tools and gages with longest possible service life at lowest initial and operating costs.

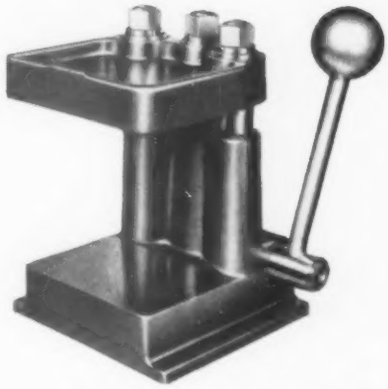
That is why Woodworth precision tools and gages must first be pre-tested—PROVED — in our own laboratories.

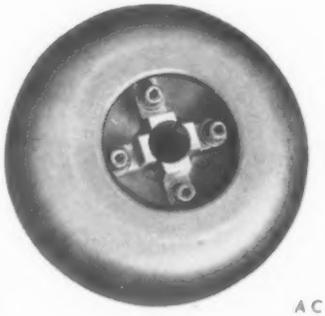
That, too, is why they're continually PROVING themselves in actual production—adapting themselves to an ever greater variety of difficult industrial applications.

2. Woodworth has made an enviable reputation in industry with its long-life thread, plug and ring gages made of such wear-tested materials as steel, Durplate, Norbide, Carboloy, Stellite and Nawlide. Write for Catalog 44-G.

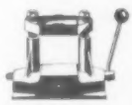
1. Speed up production and reduce costs with Limitrol. The Limitrol Comparator Type Snap Gage checks errors involving pitch diameter, lead, taper, angle, out-of-roundness. It eliminates "feel" and reduces scrap. Write for Folder 44-L.

3. The Woodworth "Cone-Lok" Jig for instantaneous positive clamping action is rugged, adaptable, mechanically simple. Fully sealed-in lubrication. Low maintenance cost. Wide range of sizes in three styles. Write for Catalog 45-J.





4. The new Woodworth Diaphragm Chuck — speedy and accurate — for precision grinding, boring and turning operations. Steps up production 2½ times. Eliminates "scrap." Write for Catalog 45-C.



Bridge Type Jig for heavy duty.

All Purpose Jig for general machine shop work.

"Up-Clamp" Type Jig for close tolerance work.

The Cone-Lok fixture clamp and Cone-Lok unit use the same principle and are available for special jigs and fixtures. Ask for data sheet.

ACCURACY YOU W CAN TRUST

WOODWORTH

N. A. WOODWORTH CO., SALES DIVISION, 1300 E. NINE MILE ROAD · DETROIT 20, MICHIGAN

PRECISION GAGES · PRECISION MACHINED PARTS · PRECISION TOOLS

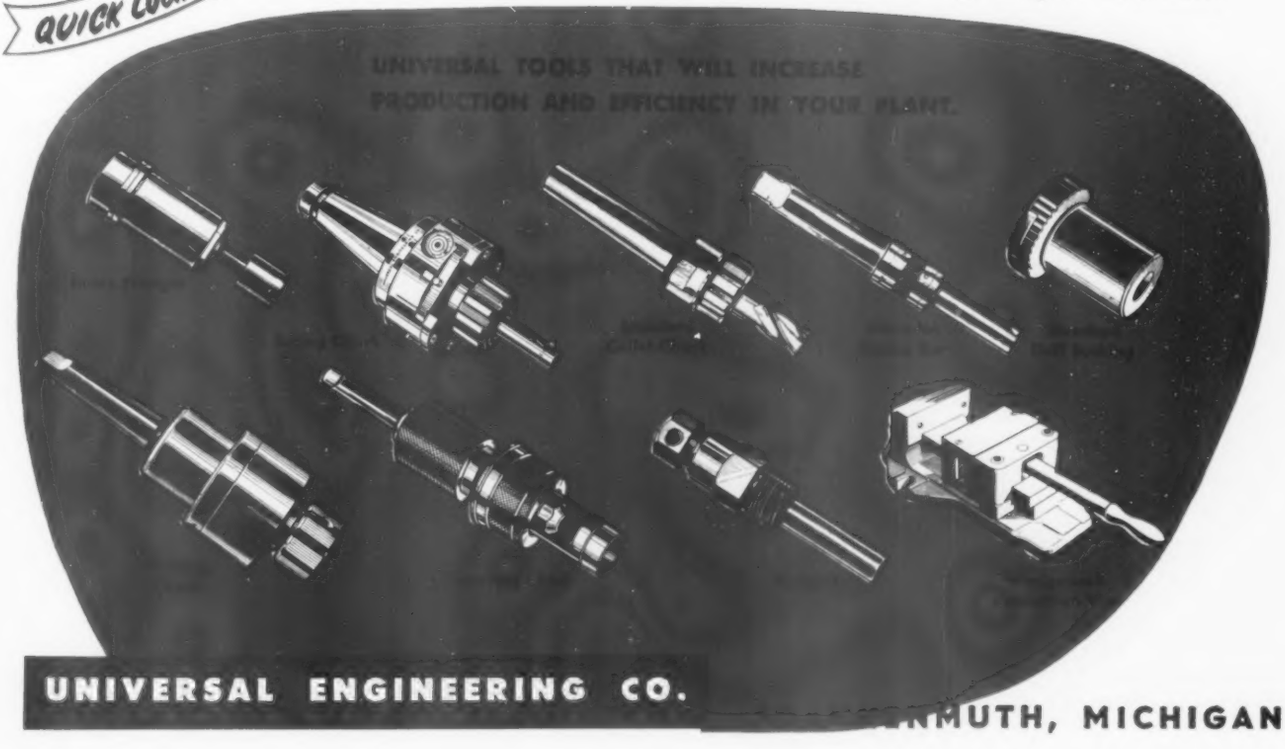
UNIVERSAL GRIPPITS AND INDEX PLUNGERS

QUICKLY LOCK AND RELEASE JIG WORK • ELIMINATE SPECIAL BUILT INDEX PLUNGERS • SIMPLIFY WORK

Universal Index Plungers and Grippits save time and money in the manufacture and use of jigs and fixtures. Universal Grippits speedily lock work for machining. Inserted through a tapped hole in jig or fixture, they take up clearance between plunger and work, clamping solidly and securely with only a one-eighth turn. No hammering, no forcing.

●

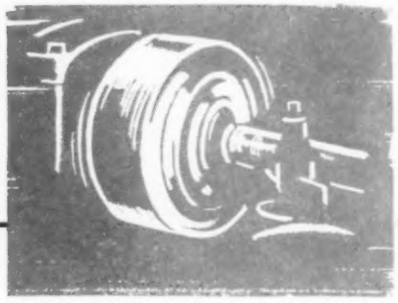
Index Plungers are standardized in three sizes and two types (tapered or straight) for multi-stationed tools. They require no designing or tool-making and are easily installed at approximately 75% less than special-made index plungers. Write for complete information.



UNIVERSAL ENGINEERING CO. **...NMUTH, MICHIGAN**

WANT POSITIVE CHUCKING CONTROL AT

HIGH SPEEDS?



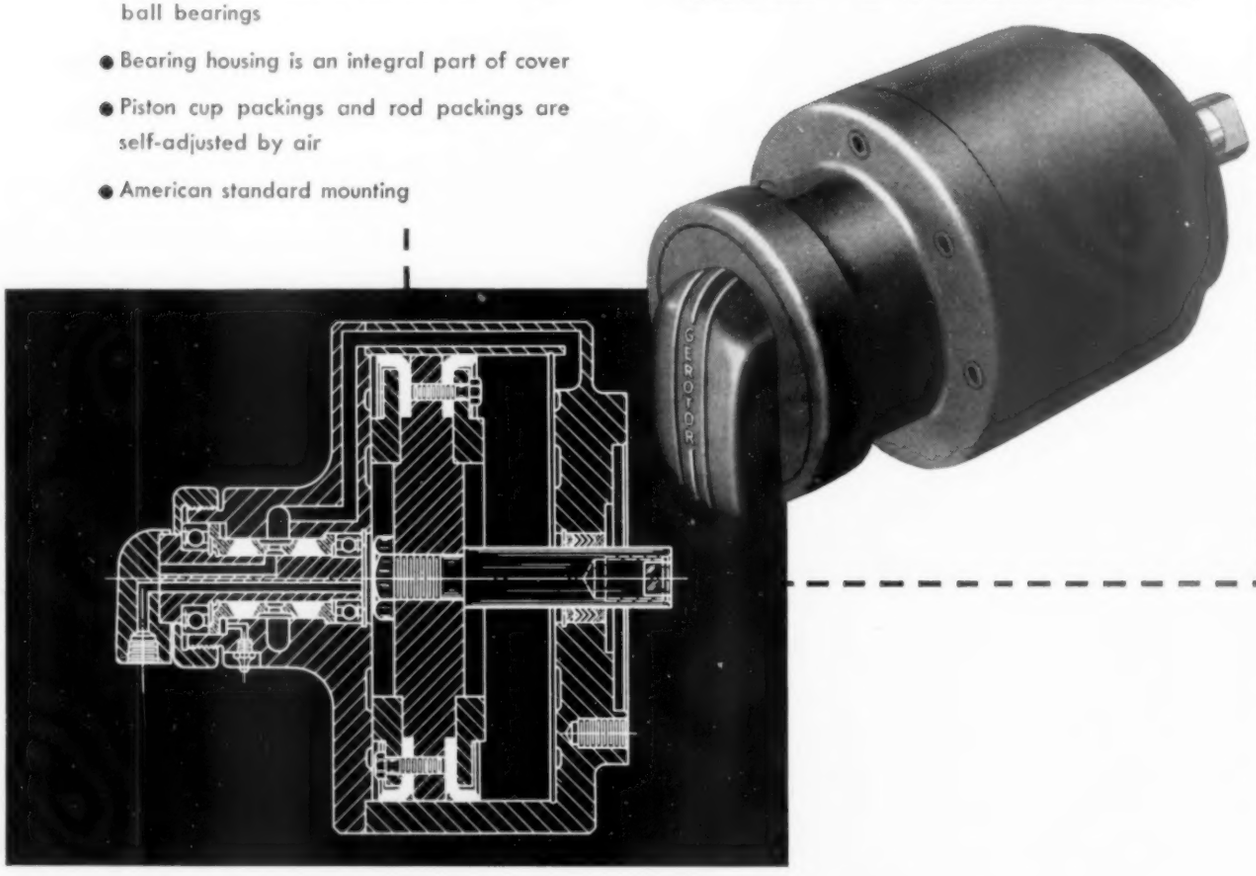
Check the

GEROTOR

ROTATING

AIR CYLINDER

- The Model 10 Gerotor Rotating Air Cylinder has been designed for use on high speed spindles to operate air chucks, mandrels and other work holding devices with permanent alignment.
- Castings are all light-weight aluminum
- Stationary stem is precision mounted on ball bearings
- Bearing housing is an integral part of cover
- Piston cup packings and rod packings are self-adjusted by air
- American standard mounting



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LOGANSPORT, INDIANA

PLANTS AT BALTIMORE, MARYLAND, • LOGANSPORT, INDIANA

CRUSHER ROLLS FOR ALL STANDARD THREADS 8 TO 32 PITCH, CARRIED IN STOCK FOR IMMEDIATE DELIVERY.

CRUSHER ROLLS FOR SPECIAL THREADS AND ANY TYPE OF PRECISION FORM CAN BE MADE TO YOUR SPECIFICATIONS.

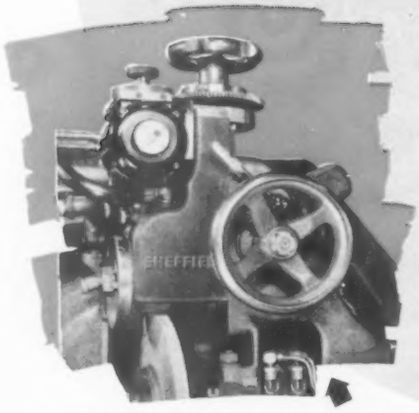
POWER CRUSHING DEVICE FOR USE ON A SURFACE GRINDER.

Headquarters

FOR CRUSH DRESSING EQUIPMENT FOR THREADS and FORMS

Grinding with crush dressed wheels has so many advantages from the standpoints of accuracy, speed, and economy that it took little time for it to become firmly established in the metal working industry. Sheffield, the American pioneer of this practice on a commercial basis, can furnish you with the equipment you need to put it into operation in your own plant.

SHEFFIELD PRECISION THREAD AND FORM GRINDER FOR DUPLICATING CRUSHER ROLLS AND THE MASS PRODUCTION OF WORK PARTS THREADED OR FORMED.



POWER CRUSHING DEVICE FOR USE ON THE SHEFFIELD THREAD AND FORM GRINDER FOR THE ACCURATE CRUSHING OF WHEELS.

SHEFFIELD MICRO-FORM GRINDER FOR PRODUCING THE ORIGINAL CRUSHER ROLL, FLAT OR CIRCULAR FORM TOOLS AND PROFILES OF ALL KINDS.

THE SHEFFIELD CORPORATION

Dayton 1, Ohio, U.S.A.

MACHINE TOOLS • GAGES • MEASURING INSTRUMENTS • CONTRACT SERVICES

SHEFFIELD MASTER CRAFTSMEN

FACTS about THREAD MILLING CUTTERS

Multiple thread milling cutters are usually made as wide as the portion to be threaded. This permits threading to be completed in one revolution of the work. When sharp "V" threads are to be milled, "staggered tooth" cutters are recommended.

For all types of thread milling cutters, you are assured accurate work at minimum cost when you specify NATIONAL tools—the National choice.

Call Your
DISTRIBUTOR!

Leading distributors in every section of the country have stocks of National Cutting Tools. Every National distributor offers factory trained engineers to serve you. Call your National distributor for cutting tools or any staple industrial product.

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TWIST DRILL AND TOOL COMPANY
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NATIONAL TWIST DRILL & TOOL ROCHESTER MICH. U.S.A.

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SHORT CUT TO MASS PRODUCTION BALANCING of Crankshafts, Impellers, Armatures, Etc.

Get all the facts about OLSEN STATIC-DYNAMIC BALANCING EQUIPMENT

Here between two covers are all the facts about the complete line of Olsen E-O Balancing Machines.

Bulletin No. 26 details construction and operation of Olsen equipment which is widely used and preferred for its simplicity, accuracy, and ease of operation.

If balancing is one of your problems, or, if you'd like to know how to improve your product by balancing, fill out and mail the coupon below and we'll put a copy of Olsen Bulletin No. 26 in the mail to you.

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COVEL NO 12

UNIVERSAL CUTTER AND TOOL GRINDER

for Modern Efficiency in your Tool Room

Combining a universal utility with high productivity and life-long precision, Covel offers you the No. 12 for a wide range of tool room work. A rugged, dependable machine, it will do more jobs, better — and at less cost. For modern efficiency, install a No. 12 in your shop. It will pay for itself quickly.

Rear view shows simple, clean-cut design of entire machine. Base is ribbed for rigidity — one of a multitude of advantageous features built into this time-saving grinder.

See Your nearest Dealer or write for 12-page bulletin **TE 26**

GRINDING MACHINERY SINCE 1874

COVEL INDUSTRIAL GRINDERS

COVEL MFG. CO., BENTON HARBOR, MICHIGAN U. S. A.

A DOUBLE SAVING with SCULLY-JONES Style A TAP CHUCKS

① Reduce tap breakage and time lost for changing.

② Speed up production by quick insertion and ejection.

See pages 25, 26, 27, Scully-Jones Catalog No. 500

In a standard spindle with a Morse Taper Hole

In Scully-Jones Floating Holder

In Floating Tension Type Tap Driver for Magic Chuck

In a Magic Quick Change Chuck

In a Spring Compression Tap Driver

Universally used for individual or modern mass production, the Scully-Jones Style "A" tap chuck is a one-piece tool designed for driving taps in any type of machine having a spindle, holder or attachment with a Morse taper hole.

True-running, definite stop, positive drive, smaller in diameter than spindle, quick insertion and easy ejection, are advantages that reduce tap breakage and speed up production.

Write for our complete listing of sizes.

5 Big FEATURES

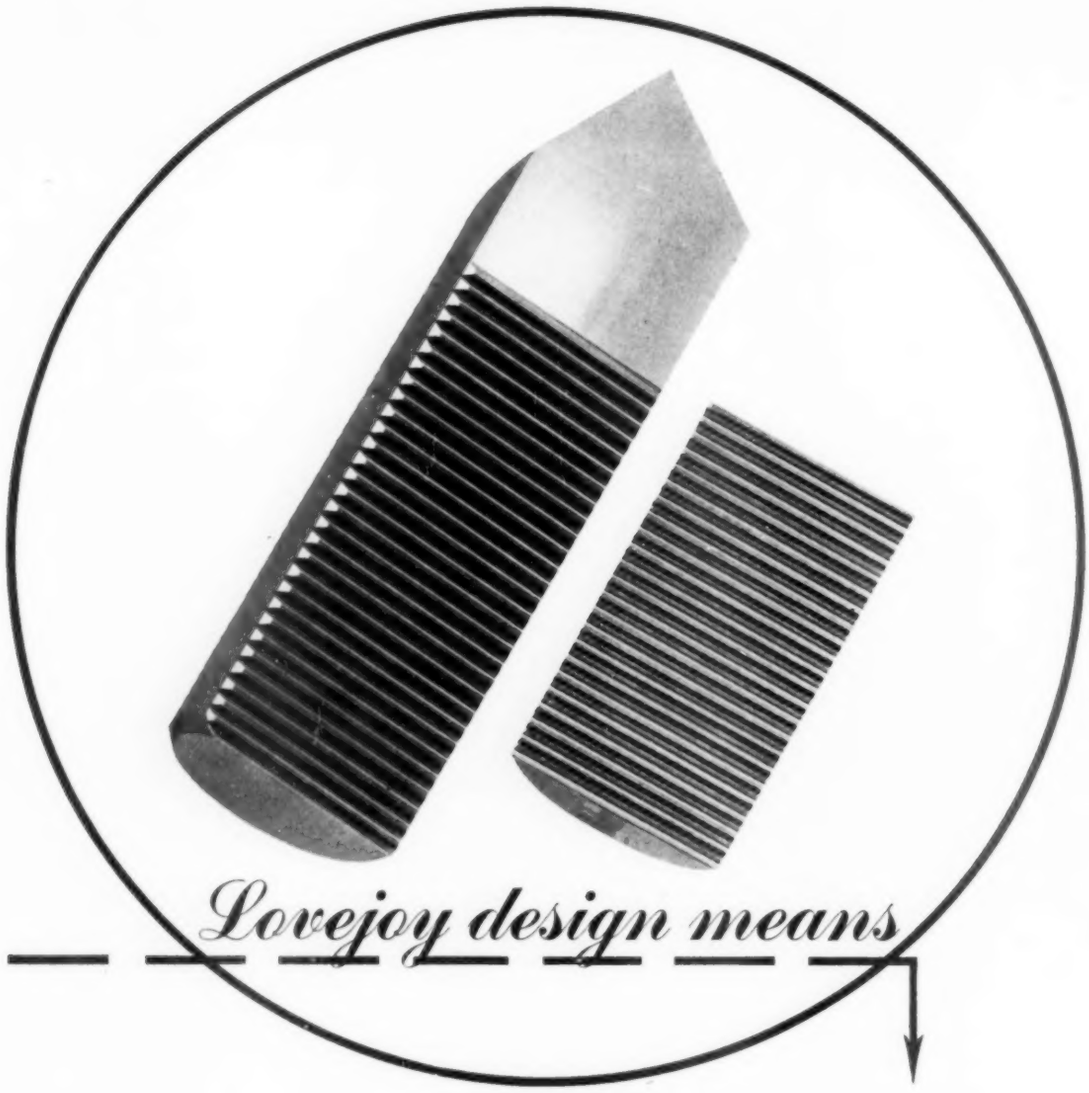
STYLE "A" TAP CHUCKS

1. Drives By Square—a positive drive
2. Centers By Shank—for correct alignment
3. Collet Action—locks tap in chuck
4. Taper Shank—fits any M.T. hole
5. Four Point Bearing—gives collet action

Refer to the Scully-Jones Catalog showing over 500 types and sizes of cutting tools, collet chucks, boring equipment, centers, etc.

Scully-Jones AND COMPANY

1907 SOUTH ROCKWELL STREET • CHICAGO 8, U. S. A.

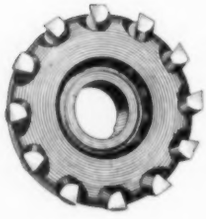


Lovejoy design means

LONG LIFE
For blades — because fine serrations on shoe and blade mean less stock removal at each resharpening. For body — because of forged steel construction and precision ground locating surfaces.

RIGIDITY
The blade and shoe form a cylindrical shape to *fit* the round hole in the housing. The locking wedge completes the immovable, "Positive-Locking," assembly.

FAST STOCK REMOVAL
Each blade is husky — carbide tips are backed up with plenty of steel. Serrations are on the front of the blade — not on the back, or locating side. Lovejoy cutters will take everything the work or machine has to offer. (Better check up on Lovejoy negative rake cutters, too!)



PROMPT SERVICE
The blades in Lovejoy cutters are interchangeable over a wide range of sizes. This means less stock for you to carry, and Lovejoy can ship H. S. S., Carbide or cast alloy blades, in all popular sizes, the day the order is received.

THE RIGHT TOOL FOR THE JOB
Lovejoy tools include a complete line of milling cutters, arbors, counterbores, special boring heads, single point tools, boring and facing bars, and turret tool posts. They're all "Positive-Locking"— they're all described in detail in Catalog No. 27. Write for your free copy.

LOVEJOY TOOL COMPANY, Inc. **Springfield, Vermont**

Marvel

Low carbon—high tungsten, for top service at dull red heat. Maintains hardness, resists heat cracks. High toughness—high wear resistance—high heat resistance.

Choice

High carbon—chromium, excellent wear resistance. Specially adapted for compressive forming.

Hotform

The original 5.00% chromium steel in this field—most widely used in hot work on aluminum-base and other alloys. Exceptional strength at elevated temperatures.

Die steels for hot work*

Extrude Die

Resists softening at temperatures up to 1300°F. Used for special hot work where extreme toughness is not required.

Hotpress

Low carbon—low chromium—high tungsten. For rod and tube extrusion, general hot pressing. High toughness—high heat resistance—stands water cooling.

Formdie

13.50—14.50% tungsten. Delivers exceptional service on upsetter headers and dies, piercing punches, etc., resisting heat checking and scoring. High strength—high heat resistance.

All of the above steels are available in billets, bars, cold drawn shapes, solid forgings, ring forgings, sheet, plate, circles and drill rod.

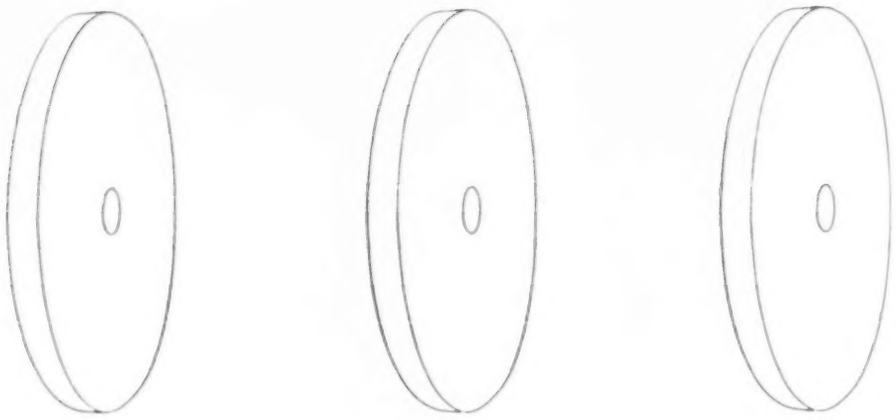
*** One of the series of six Vasco Tool Steel Classifications covering every industrial requirement.**

Vanadium-Alloys

STEEL COMPANY

LATROBE, PENNA.

COLONIAL STEEL DIVISION | **ANCHOR DRAWN STEEL CO.**



C-GRADE H-GRADE R-GRADE

There's more to grinding grades than the A, B, C's

The A, B, C's which appear as identification on a grinding wheel help simplify proper grade selection. By clearly showing relative hardness, they make your choice quicker, easier...aid in assuring the right grade for the job. That's one reason wheels by CARBORUNDUM are plainly marked. But, there's more to it than the old chestnut, "the softer the metal, the harder the wheel." It's not that easy.

You realize, for instance, that wheel speed itself affects grinding action. The same grade reacts differently at various speeds. The condition of the machine and the amount of vibration can make a difference. Desired finish...required tolerance must be considered. Coolant conditions vary. The actual type of operation—snagging, surfacing, internal grinding or whatever it is—influences practical selection.

Yes—there are many important factors to check before you can be sure of the right grade designation for the job.

That's why we suggest consulting your CARBORUNDUM salesman or our distributor's representative. These men work throughout the year on a wide variety of grinding problems. They are familiar with grinding in production... in tool rooms...wherever it is used. They have practical knowledge and experience to help you pick exactly the wheel you need for the job.

Assisting these representatives in the field are our Abrasive Engineers. Specialized experts, they are equipped to analyze uncommon problems...recommend sound solutions. And, here in our modern laboratories are scientists and technicians who are working on the application of abrasive developments to changing grinding practices.

This *three way route* to better grinding is easy to use. No obligations are incurred. Merely talk "grinding" with a CARBORUNDUM representative. He'll be glad to assist you. The Carborundum Company, Niagara Falls, N. Y.

A good rule for good grinding . . . **CALL IN**

CARBORUNDUM

TRADE | MARK

ABRASIVE WHEELS

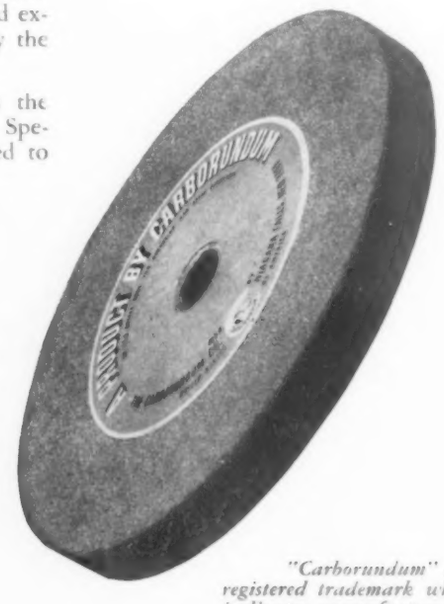
Silicon Carbide
Aluminum Oxide
Diamond

COATED AND BONDED ABRASIVES

Paper and Cloth Combinations
Sheets, Rolls, Discs
Cylinder Hones
Sticks, Stones & Rubs
Specialties

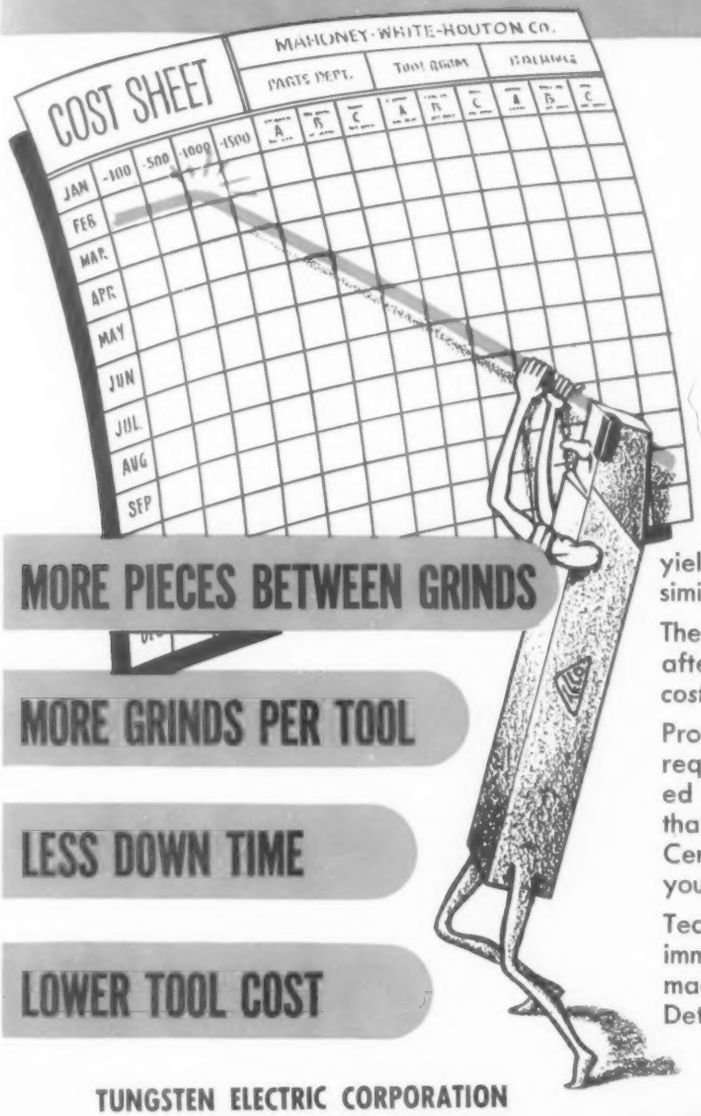
ABRASIVE GRAINS AND COMPOUNDS

for:
Polishing
Lapping
Pressure Blasting
Finishing



"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company

Here's one proven way to
GET MACHINING COSTS DOWN!



MORE PIECES BETWEEN GRINDS

MORE GRINDS PER TOOL

LESS DOWN TIME

LOWER TOOL COST

TOOL UP WITH

TECO

Cemented Carbide

TECO Cemented Carbide has extraordinary resistance to wear and breakage. It holds a cutting edge longer. It machines many more pieces per grind. It yields far greater production per tool than any similar material.

These are facts—proved over and over, on job after job, in scores of plants *where machining costs must be kept down to rock bottom.*

Prove it yourself! Select any job where carbide is required. Replace present tools with Teco Cemented Carbide. Then check the output. You'll find that the harder, tougher, more uniform Teco Cemented Carbide out-produces any carbide you have ever used.

Teco Cemented Carbide Tools and Blanks are immediately available for practically every machining need. Write us your requirements. Detailed catalog is ready for mailing.

TUNGSTEN ELECTRIC CORPORATION
39th Street, UNION CITY, N. J.

TECO
CEMENTED CARBIDE
Pioneers in Tungsten Carbides for over a Quarter Century

Branch Office: 2906 Euclid Avenue, Cleveland, Ohio
Representatives: Indianapolis, Ind., Chicago, Ill., Detroit, Mich.

MORE BUYERS *Specify* BESLY TAPS

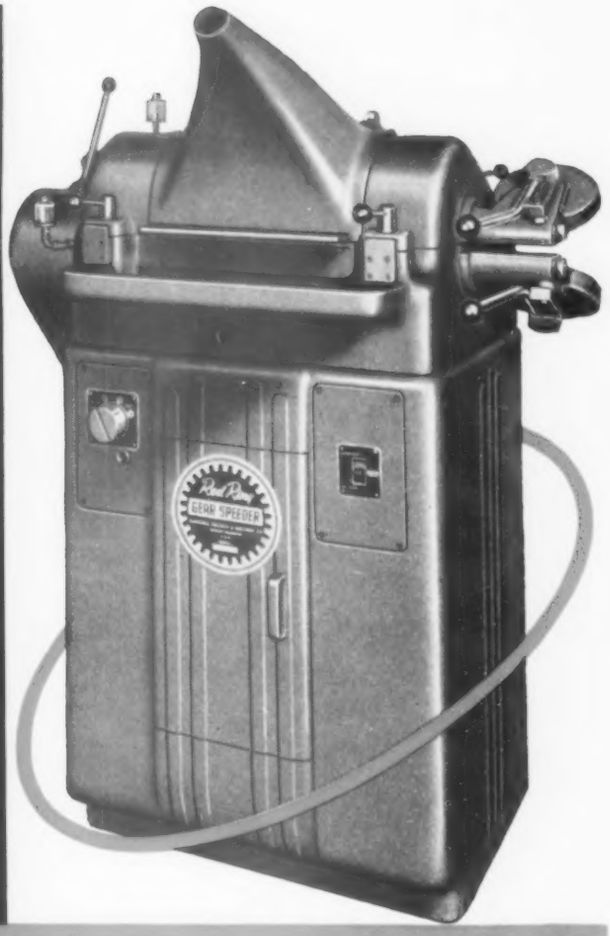
Significantly, a growing nation-wide acceptance of Besly quality and products is clearly indicated by the simple fact that today *more manufacturers* are buying Besly Taps than at any time in our 52-year history. Ample stocks are now available for immediate shipment from our central location. Write today on your business letterhead for copies of the new Besly Catalog and Tap Manual.

BESLY

BESLY TAPS • BESLY TITAN ABRASIVE WHEELS
BESLY GRINDERS AND ACCESSORIES

CHAS. H. BESLY AND COMPANY, 118-124 N. Clinton St., Chicago 6, Ill., Factory: Beloit, Wis.

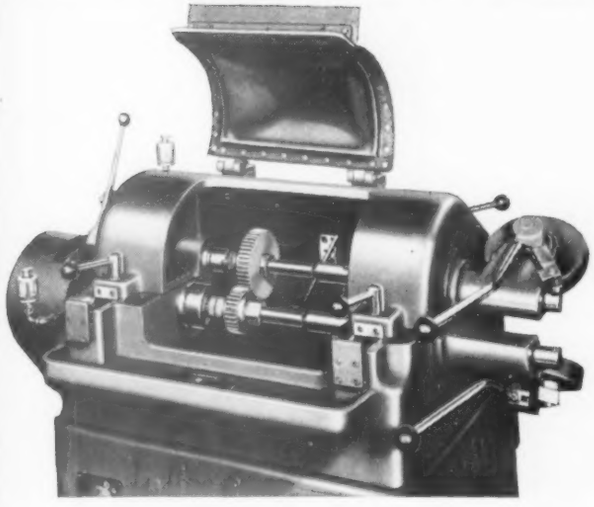
Don't Let NOISY GEARS Reach Assembly



There is no excuse for incorporating noisy gears in any assembly where gear noise cannot be tolerated. Find out before those gears reach assembly whether or not they are noisy and avoid the necessity of tearing down the assembly in order to replace them with quiet gears.

That is precisely the function of The Red Ring Gear Sound Tester. It will always spot noisy gears. Furthermore, it will indicate the nature of the trouble which causes the noise so that it can be corrected.

The acoustical horn of this machine amplifies gear noise 50 times. Center distance between gears in the sound chamber may readily be set with precision gage blocks. Gears may be tested either with or without brake load.



NATIONAL BROACH AND MACHINE CO.

1806 **5600 ST. JEAN** RED RING PRODUCTS **DETROIT 13, MICH.**

SPECIALISTS ON SPUR AND HELICAL INVOLUTE GEAR PRACTICE

ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORMS

THIS NEW

Broach Tooling Service

ELIMINATES TRY-OUT TROUBLES

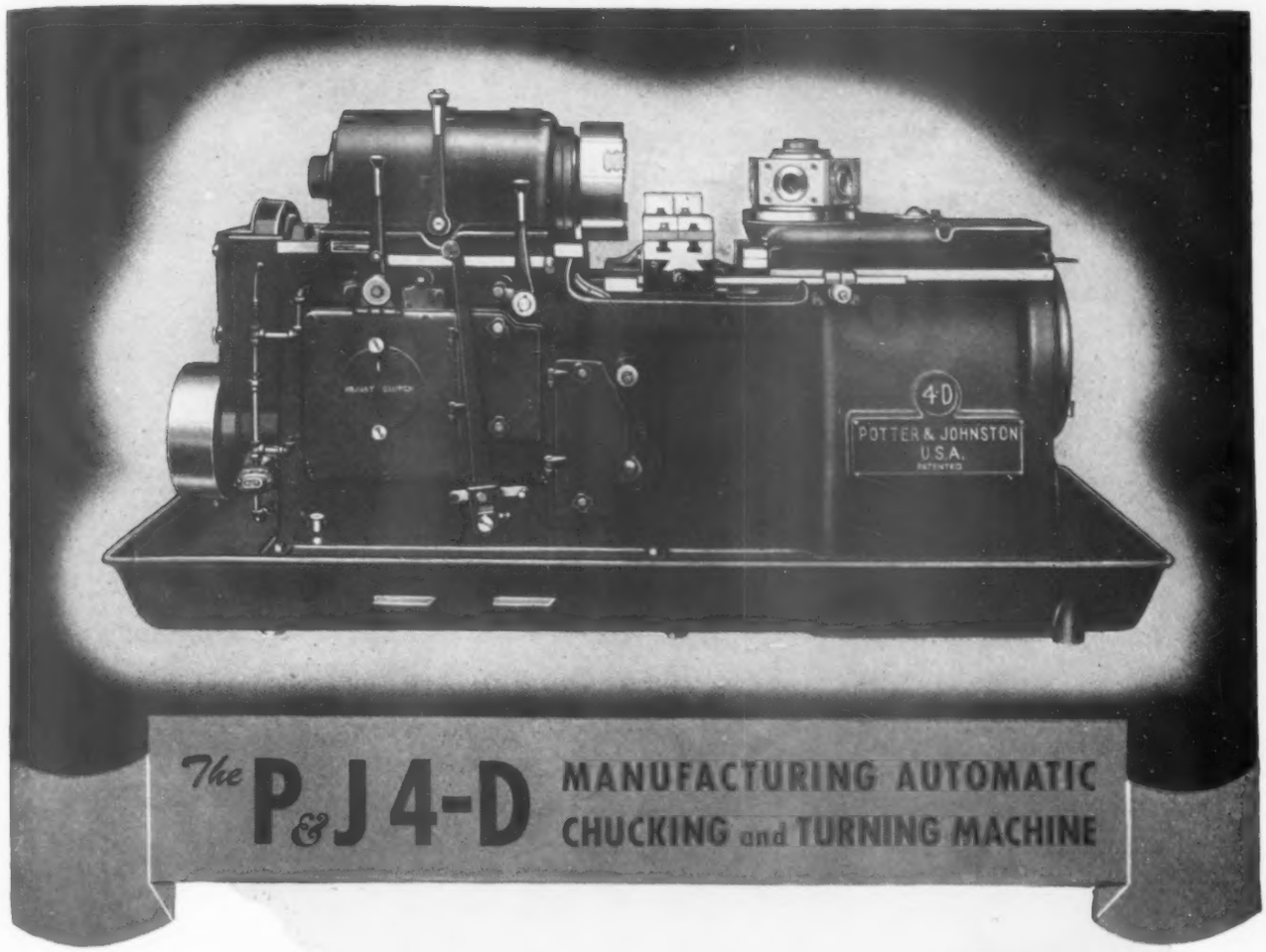
IN addition to a staff of competent field engineers to help you set up your broaching job and get it running, Detroit Broach Company offers a new service. We are now prepared to set up your machine here at our plant, try it out and then ship it to you ready to run. Your job will be set up by men who know broaching from start to finish so that when the tooled-up machine arrives at your plant it is ready to go into production without delay.

Detroit Broach Service is complete. It includes recommending equipment and methods, tool and fixture design and manufacture, set-up and try-out, field service and contract broaching on our own machines. Let Detroit Broach engineers prove the efficiency and economy of this modern metal-cutting method by giving you actual cost and production figures on your own job.

MEMBER BROACHING TOOL INSTITUTE

DETROIT *Broach* COMPANY

20201 SHERWOOD AVENUE • DETROIT 12, MICHIGAN



The P&J 4-D MANUFACTURING AUTOMATIC CHUCKING and TURNING MACHINE

PERFORMANCE PROVED for ACCURACY and LOW COST PRODUCTION . . . . . .

Many production problems involving the duplication of small parts have been solved by the Model 4D P&J machine. Time and again it has demonstrated its superiority over hand machines as a means of improving quality of work and of reducing costs.

This machine is of compact design and rugged construction. Features include: a high carbon forged steel spindle mounted on Timken Tapered Roller Bearings; headstock gearing of Chrome Nickel Steel, heat treated; all shafts of heat treated alloy steel mounted in ball bearings; 15 speed changes between 24 and 335 R.P.M. arranged in five sets of three automatic changes; 27 feeds in geometric progression.

CONDENSED SPECIFICATIONS

Swing over bed—21" dia.
Swing over cross side—9¾" dia.
Cross slide travel—each way—3¼"
Number of turret faces—5 std. 4 and 6 spec.
Hole in turret—2" dia.
Turret feed—5½"

Send for Bulletin 112 Giving Complete Details

It's time to buy EXTRA Victory Bonds

POTTER & JOHNSTON MACHINE CO.
Pawtucket, Rhode Island

HOW YOU CAN *Double* DRILL PRESS PRODUCTION *in less than 20 minutes!*

At no increase in wage cost—with fewer rejects—less worker fatigue

Suppose you could have one operator run two or more standard drill presses, as fast, or even faster than he could run one? with less actual physical effort? with better-maintained standards of quality? It would help to beat the squeeze between rising costs and fixed selling price, wouldn't it?

You can. It's being done. In less than twenty minutes you can take practically any standard hand-fed drill press and convert it into a high-production unit. Plant after plant where Bellows Controlled-Air Power Drill Press Feeds have replaced hand-feeding, report production increases ranging from 40% to 500%.

For example, a Columbus, Ohio, manufacturer reports one operator is running two drill presses, facing 60° "L's" in 10-20 steel and obtaining better than twice the production he formerly obtained by hand feeding, and with less work.

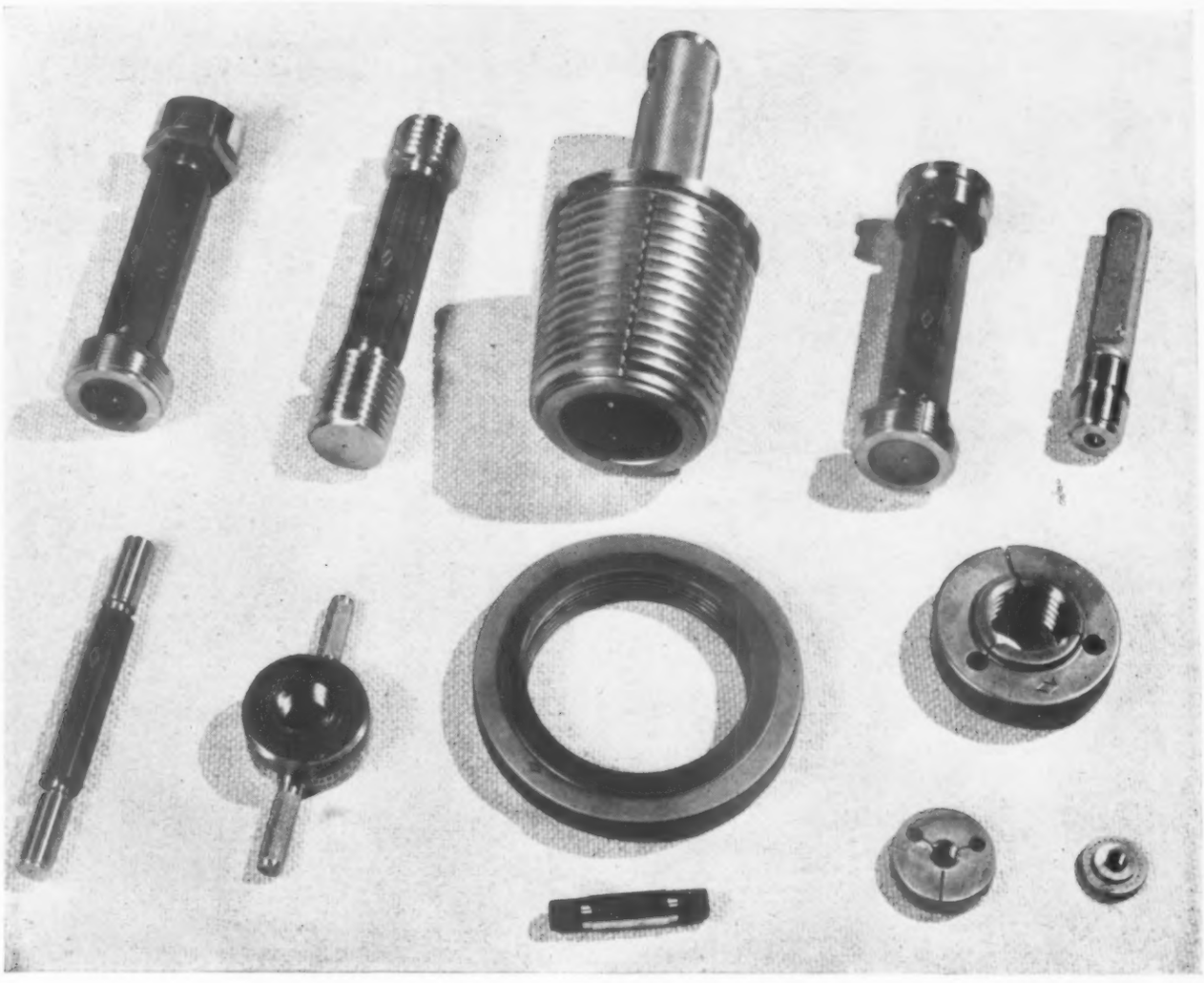
A Holland, Michigan, firm tells how they converted an old two spindle tapper into a unit producing more than 2500 tapped die cast parts per hour.

A Chicago parts manufacturer reports one operator running three spindles—the first two fed by Bellows Controlled-Air-Power Feeds, the third spindle fed by hand.

The Bellows Controlled-Air Power Feed attaches to the star wheel shaft of the drill press. A touch on the operating handle advances the spindle any selected distance, at any desired pressure and feeding rate. When the operation is completed the spindle automatically returns to starting position. The easily accessible controls for stroke length, feeding pressure, and feeding rate (more sensitive, more accurate, than the "touch" of the most skilled operator) permit proper feeding of any tool in almost any material.

Investigate quickly this inexpensive way of getting greater output, at less cost, from your present machines. Write for your free copy of Bulletin DF-100, today.

The Bellows Co.
Senacon Division
861 E. Tallmadge Ave. • Akron 10, Ohio



When you want Gages *Quick!*

Here at Pipe Machinery, we maintain large stocks of standard plug, ring and thread gages—all of established PM standards of accuracy and finish.

When emergencies arise—when you need gages in a hurry—just write, wire or phone us. Often we are able to give you one-day service on shipments.

Of course we make special gages, too—on receipt of your specifications, will gladly quote prices and delivery dates.

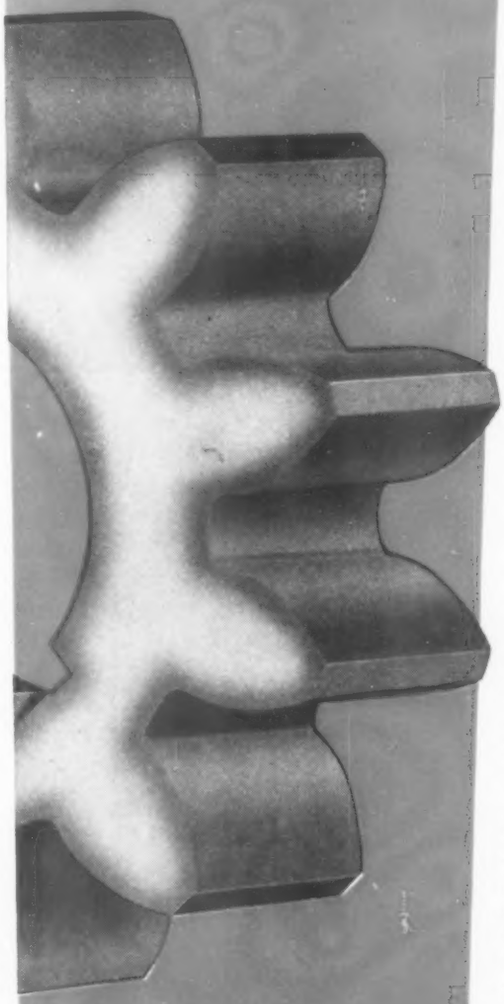
Two things you can always depend upon when your gages carry the PM trade mark—original accuracy of dimension and extra good finish for long wear.

PMCO

ARMY NAVY

The PIPE MACHINERY COMPANY Cleveland, O.

GAGES • HOBS • MILLING CUTTERS • SPECIAL TOOLS



You get...

1. RAPID penetration

2. UNIFORM case depth

3. SIMPLE operation

....when you use Park-Kase LIQUID CARBURIZERS

UNIFORM carbon case depths up to an eighth of an inch are produced RAPIDLY and SIMPLY by PARK KASE Liquid Carburizers. Distortion is reduced to a minimum by even heating rates, uniform case depths, accurate temperature control, and ease of direct quenching.

The operation of a PARK KASE salt bath requires no rigid chemical controls or strict replenishment schedules. Complicated furnace equipment and skilled personnel are unnecessary. Only ONE PRODUCT is required; carburizing activity and the carbon cover are maintained by additions of the same salt. The incorporated carbon cover inhibits salt decomposition, prevents fuming and saves fuel.

Steel parts carburized in PARK KASE show wear resistance superior to gas or compound carburized work. Temperatures up to 1750 deg. F. may be employed for carburizing and reheating. Three hours at 1600 deg. F. produces a total case of .031" while a case depth of .052" is the result of only five hours at 1700 deg. F.

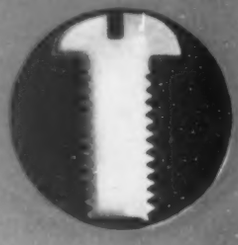
PARK KASE ranks among the major recent developments in the heat treatment of steel. Write today for descriptive bulletin.

A new kind of Stop-off Paint

PARK "NO-KASE" . . . a new development in stop-off paints . . . provides positive protection against carburization in liquid carburizing baths. Even the most difficult sections (see photograph right) are protected. Write for bulletin E-16 which has full data and prices.

Left: Note clear cut line between protected and unprotected areas. "NO-KASE" USED.

Right: Note complete lack of penetration on protected section of bolt. "NO-KASE" USED.



Park

PARK CHEMICAL CO.

DETROIT . . . MICHIGAN

● Liquid and Solid Carburizers • Cyanide, Neutral and High Speed Steel Salts • Coke Lead Pot Carbon • Charcoal • No Carb • Carbon Preventer • Quenching and Tempering Oils • Drawing Salts • Metal Cleaners • Kold-Grip Polishing Wheel Cement

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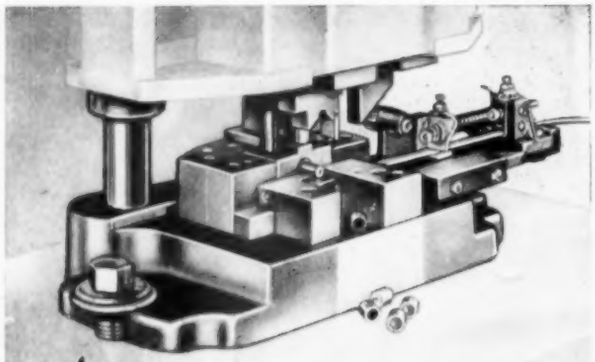


for

PEACETIME PROFITS

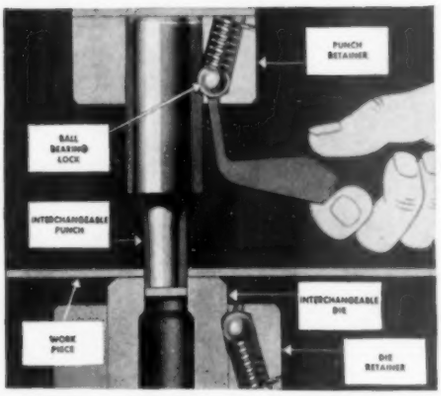
With Dickerman Hitch Feeds for your punch presses, you'll get top production at rock-bottom cost. They are accurate, reliable and easily changed from one die to another. Send now for descriptive booklet.

DICKERMAN HITCH FEEDS

MANUFACTURED BY

H. E. DICKERMAN MFG. CO.

321E Albany St., Springfield 9, Mass.



The Original Inter-changeable Punch and Die

● Allied's R-B Interchangeable Punch and Die lowers costs in the metal working and plastic industries. Standard punches and dies carried in stock. Special shapes and sizes in any material made to your specifications with prompt deliveries. Send for large illustrated R-B catalog, now.

ALLIED PRODUCTS CORPORATION

Department 29E • 4630 Lawton Ave. • Detroit 8, Michigan

FOR EXTRA SPEED AND ECONOMY

Replace those old-style solid cutters

Once the present back-log of unfilled orders disappears and we return to a buyer's market, shops with up-to-the-minute equipment will get the business with far less expense than will those still clinging to old-style, worn-out tools. You will have a head start if you will begin by replacing your outmoded solid milling cutters and lathe, planer and shaper tools with O K Inserted-Blade Metal Cutting Tools. In these tools, only the cutting edges are made of the less expensive, but exceedingly strong, alloy steel. The blades or bits that do the cutting may be readily adjusted in line of wear—replaced with others from the tool crib—or shapes may be ground for special jobs. With the O K System, you handle a wider variety of work—get more out of your tools—DO A BETTER JOB!

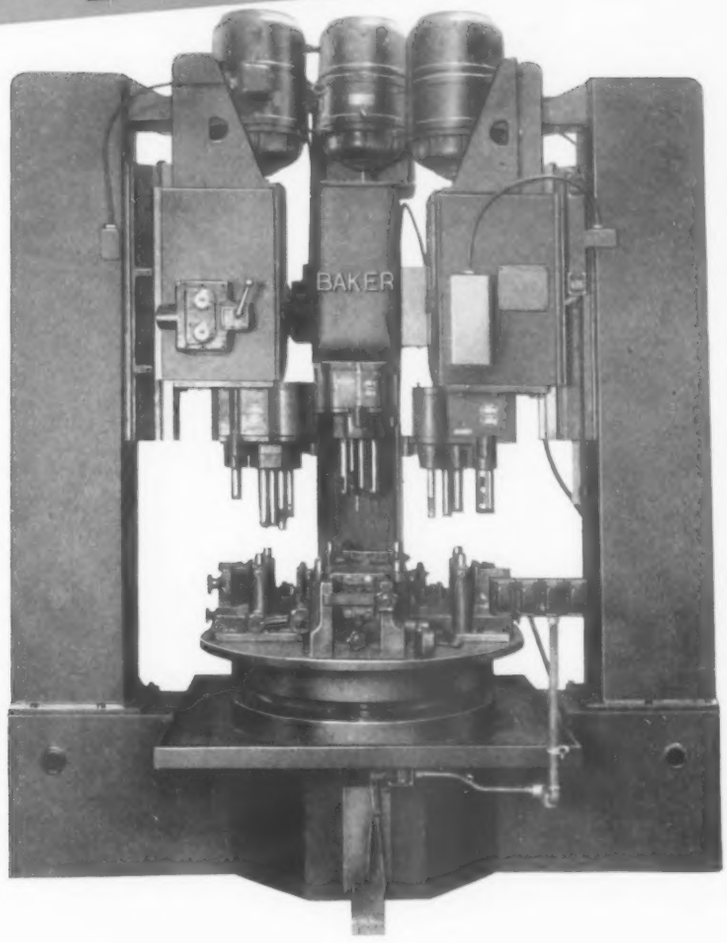
An O K Milling Cutter for milling locomotive side rods and other heavy duty jobs. One of scores of O K designs of milling cutters.

INSERTED-BLADE METAL CUTTING

TOOL SYSTEM

MANUFACTURED ONLY BY THE O K TOOL COMPANY, SHELTON, CONN., U. S. A.

BAKER provides flexibility

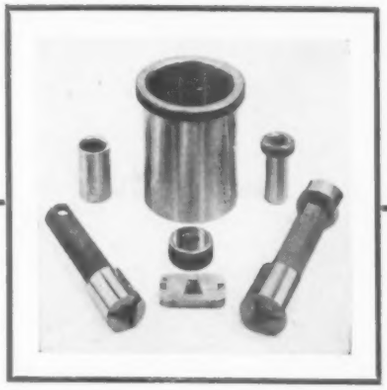


FOR HIGH PRODUCTION WITH SINGLE AND MULTIPLE SPINDLES

Baker multioperation machines are made to give modern production the flexibility that creates profits. Parts can be loaded and unloaded in chucking position while machines are in operation. Speeds and feeds can be changed at one station without affecting the operations at other stations. The variable delivery Vickers-type pump has automatic cycling. In the machine illustrated, wider ways and larger feeding cylinder add to its production possibilities. Baker machines are fast, accurate, flexible and dependable. For increased unit production at lower cost, buy Baker. *For full particulars without obligation, write or wire Baker today.*

BAKER BROS., INC.

Toledo 10, Ohio



ECONOMY stands ready, with an engineering staff backed by years of dependable experience, to offer its assistance as a final solution to your DRILL JIG BUSHING and GAGING problems.

Save time and expense by having your UNDERSIZE GAGES reconditioned to original or specified sizes and tolerances, by HARD CHROMIUM PLATING.

Write today for particulars

ECONOMY TOOL & MACHINE CO.

MILWAUKEE 14, WISCONSIN

GROUND AND LAPPED FOR PRECISION KNURLING

REED KNURLS

More than 100 Different Styles and Sizes IN STOCK for Prompt Delivery. All Standard Knurls now available in either CARBON Steel or HIGH SPEED Steel.

Special Knurls made to your specifications

New Catalog 62 Sent Upon Request

REED SMALL TOOL WORKS

WORCESTER 2, MASSACHUSETTS

MARVECO

. . . COMPARISON . . .

Compare MARVECO construction (consisting of only a shank, head and two bearings) with those Centers made up of a dozen or more parts. Comparison shows why engineers consider MARVECO the best.

The MARVECO is GUARANTEED to OUTPERFORM and OUTLAST any other LIVE CENTER.

Our illustrated catalog will be sent upon request. See for yourselves the MARVELS of MARVECO.

Send us Your

CENTER PROBLEMS

MARVEL TOOL & MACHINE CO.

10981 W. JEFFERSON AVE., RIVER ROUGE 18, MICHIGAN

WE make these surveys right along, and they result in a common-sense plan to assure correct application of the right lubricants. Briefly, this is what the Shell Lubrication Engineer will provide:

1. Survey and analysis of the lubrication requirements of your plant engines and machines.

2. Recommendations of proper lubricants, together with specific instructions as to when and how they should be used.

3. Scheduled check-ups for all critical or unusual machinery.

4. Reports (if you want reports) about the performance and economies of recommended lubricants in use in your machines. To the Shell Lubrication Engineer, though, the best report is short and sweet: "All machines continuously in service, well lubricated."

* * *

Right here we ought to warn you that the Shell Lubrication Engineer isn't going to tell you everything you're doing is wrong—he may, in fact, find very little fault with the lubricants and procedure you are now using.

Then, too, he will come to you without a rigid set of rules. Your lubricating procedures are probably based on pretty sound experiences that your own folks have had. Your problem is really one of picking out the weak spots before they become trouble spots . . .

So call the Shell Lubrication Engineer for that survey. If your property is so large that he needs help, he will have it. You are bound to gain if it is only peace of mind!

There is no obligation on your part.

Call your local Shell Representative, or write Shell Oil Company, Incorporated, 50 W. 50th Street, New York 20, N. Y., or 100 Bush Street, San Francisco 6, California.

SHELL INDUSTRIAL LUBRICANTS

SHELL

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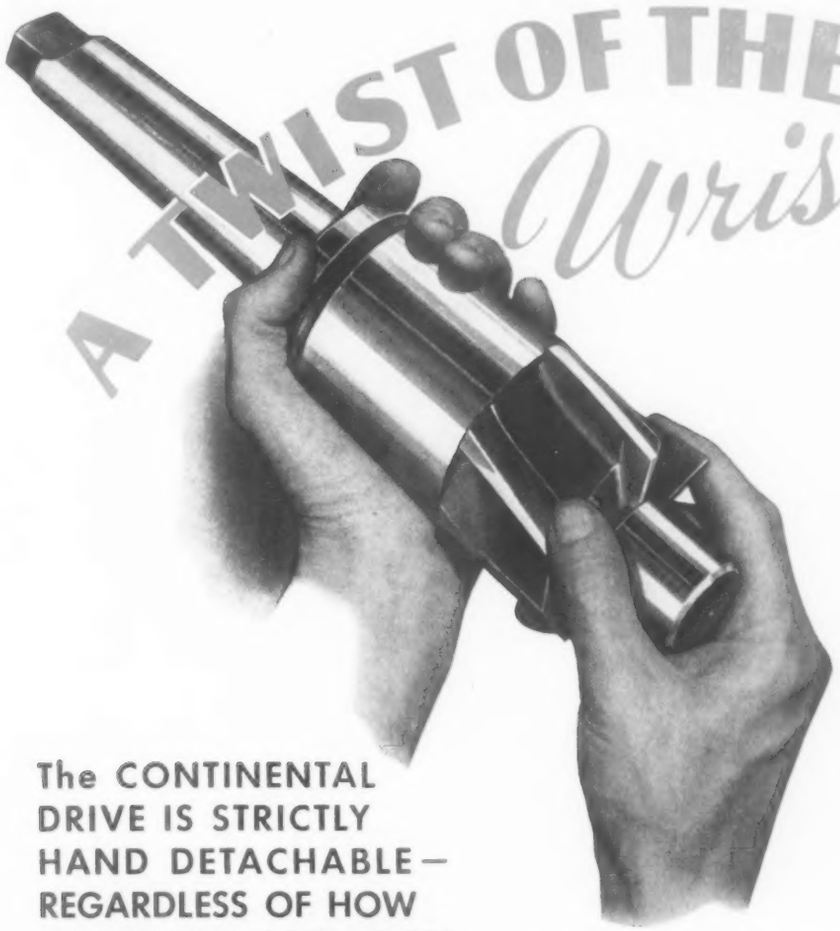
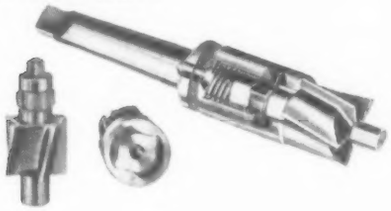
February, 1946

A TWIST OF THE *Wrist*



The CONTINENTAL DRIVE IS STRICTLY HAND DETACHABLE— REGARDLESS OF HOW SEVERE THE OPERATION HAS BEEN



With an ever-widening range of practical uses, the Continental Counterbore is proving a favorite standard cutting tool in all types and sizes of machine shops. Of rigid and simple construction, with patented features, it has long been outstanding in American industry. There's a reason: Note in illustration at left the Continental indestructible drive. It is composed of two driving lugs formed on the cutter shank, with two corresponding abutments on the inside of the holder. There is an aligning bearing above and below the driving lugs that brings the cutter and holder concentric, and prevents the cutter from being forced out of alignment. The cutter and holder are engaged and disengaged by revolving the cutter a quarter turn *by hand*. No tools or equipment are necessary.

CONTINENTAL TOOL WORKS

Division of Ex-Cell-O Corporation

DETROIT 6, MICHIGAN

CONTINENTAL TOOL WORKS

CTW

EX-CELL-O CORPORATION

Continental

CUTTING TOOLS

- Boring Bars and Tools
- Broaches
  Broach Pullers
  Broaching Fixtures
- Core Drills
- Counterbores and Countersinks
- CTW Drive Holders
- Counterbores (Tool Room Sets)
- Counterbore Pilots
- Inserted Blade Cutters
- Carbide Tipped Cutters
- Form Relieved Cutters
- Milling Cutters
- Thread Milling Cutters
- End Mills
- Side Mills
- High Speed Steel Reamers
- Carbide Tipped Reamers
- Shell Reamers
- Inverted Spotfacers
- High Speed Steel Tool Bits
- Carbide Tipped Tool Bits
- Circular Form Tools
- Cut-off Tools
- Flat Form Tools
- Dovetail Form Tools

45-46

CONTINUOUS FIBRES . . .

THE RESULTS OF

★ *COMPLETELY Cold Forging*

HOLO-KROME SOCKET SCREWS

fibro forged

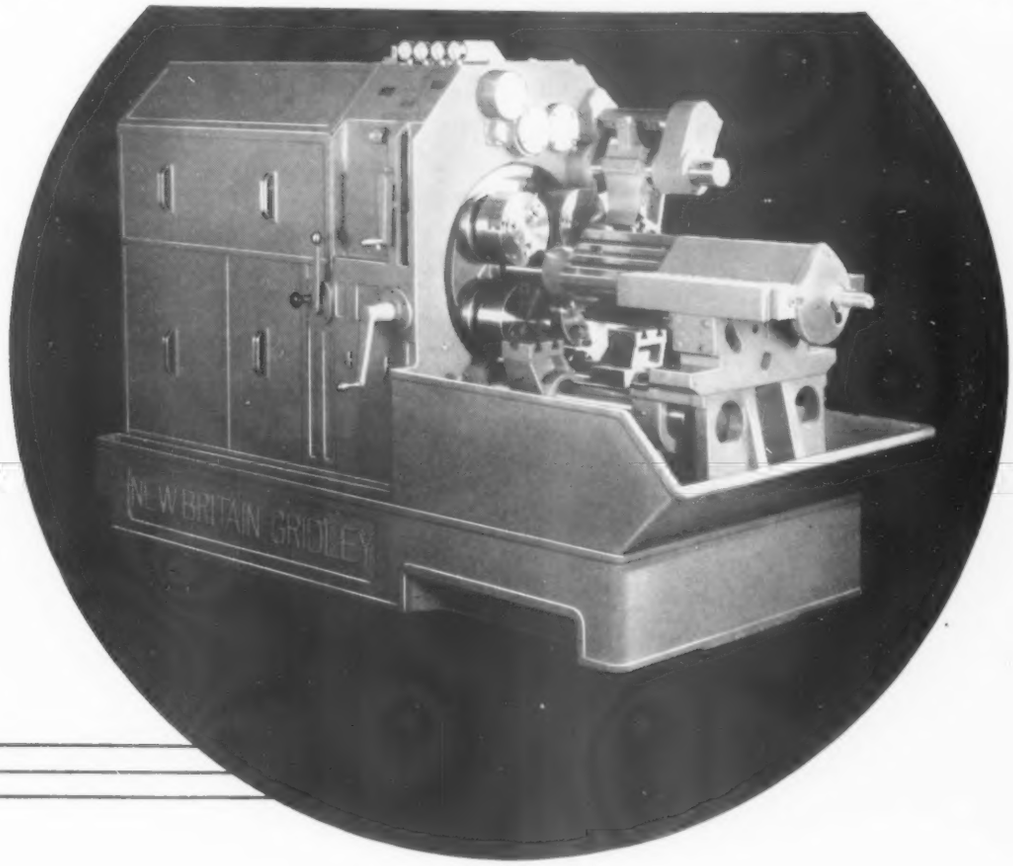
★ Method patented, owned, controlled, exclusively used by Holo-Krome.

A stronger screw! Continuous fibrous structure, uninterrupted, unboken, unsevered in Socket Screws means only one thing — Holo-Krome FIBRO FORGED Screws. The method, patented and used exclusively by Holo-Krome, inherently has this continuous fibrous structure plus the increased strength imparted by the Holo-Krome method of Completely Cold Forging . . . Specify "Holo-Krome" and benefit by Completely Cold Forging—a stronger Socket Screw!

● The H-K Socket Head Cap Screw shown above was cut in half, etched and the photo unretouched. Notice the Continuous Fibres running from end to end! ●

THE HOLO-KROME SCREW CORP. — SOCKET SCREW PRODUCTS — HARTFORD 10, CONN. U. S. A.

WIDE OPEN SPACES MEAN QUICK, EASY TOOLING



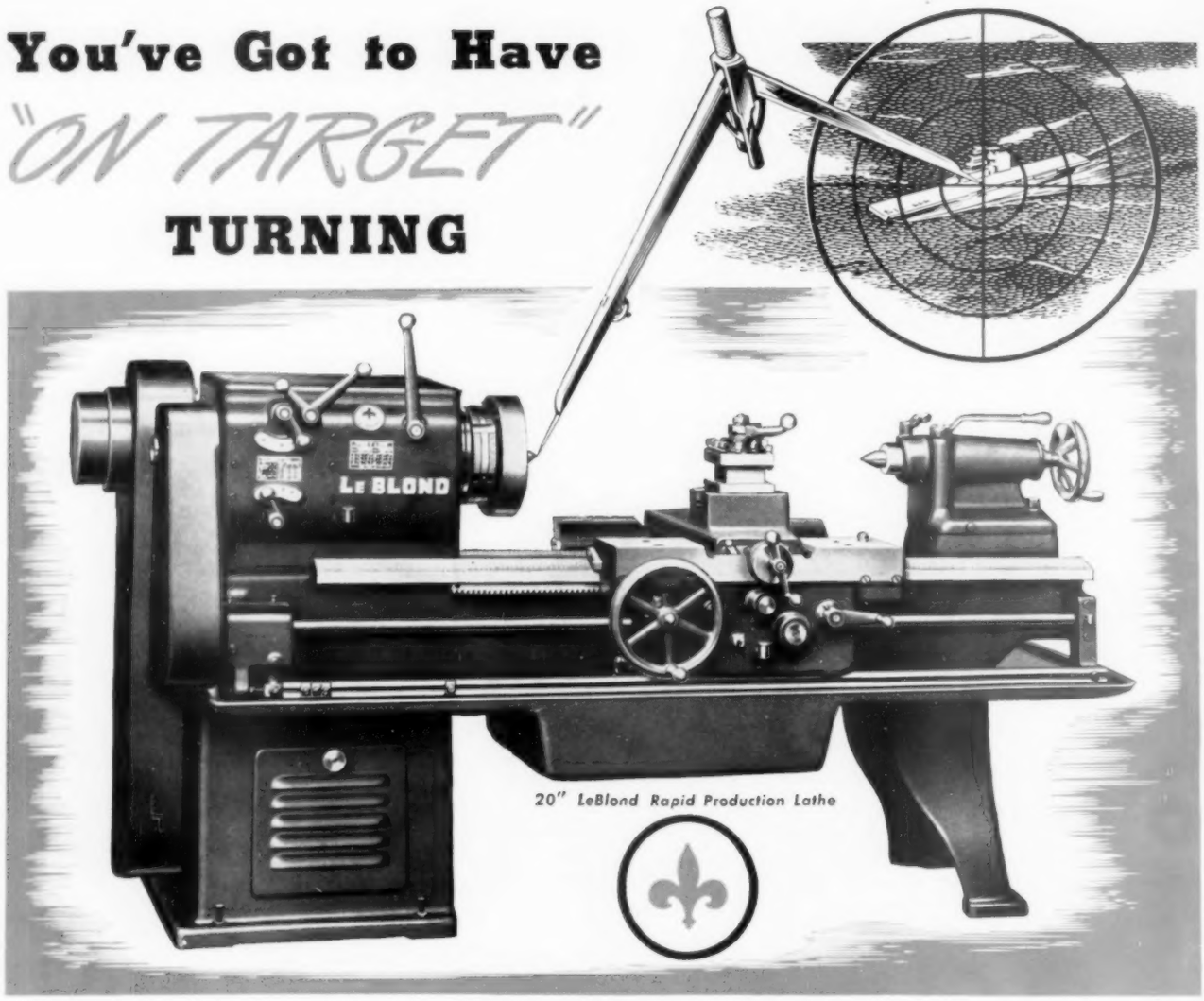
There are many reasons why New Britain stands first in multiple spindle automatic chucking machines . . . but none is more important than its wide open accessibility through ***open end construction*** to all tools and chucks, and convenient chip removal. More pieces per hour because no time is wasted reaching for hard-to-get-at points.

New Britain builds a complete line of Multiple Spindle Automatic Chucking Machines . . . four, six and eight spindles up to 12" capacity. Also a complete line of Multiple Spindle Automatic Screw Machines to 2¼" capacity.

NEW BRITAIN AUTOMATICS

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN, CONNECTICUT
NEW BRITAIN-GRIDLEY MACHINE DIVISION

You've Got to Have "ON TARGET" TURNING



20" LeBlond Rapid Production Lathe

Are you shooting with a '36 or a '46?

● Near misses in your metal cutting build production losses—penalize pricing, marketing opportunities—nick your profits. No manufacturer can hope to hit his target of competitive price when "near misses" of obsolete lathes have to stand up to the "on target" onslaught of up-to-date metal turning competition.

Are you aiming at costs with a '36 or a '46 LeBlond? Better find out before the heavy shootin' starts.

There's a man in your locality who can help you. He packs the accumulated manufacturing knowledge of 60 years, gained from thousands of installations all over the world. He'll tell you, for instance, how the "Compensating Vee" type bed positively prevents carriage climb, even under the heaviest cuts . . . how its compensates for the wear of both the carriage and the bed. His advice and experience are yours for the asking. He is the LeBlond field engineer. He will get you "on target" in your turning.

More than 50% of Industry's production and tool room lathes are more than 10 years old. How many are in your plant?

For Timed Turning that Cuts Costs
It takes a Le Blond

THE R. K. Le BLOND MACHINE TOOL COMPANY, U.S.A.

CINCINNATI 8, OHIO

New York 6, Singer Bldg., 149 Broadway, WOrth 2-0722
Chicago 6, 20 N. Wacker Drive, STA 5561

LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES